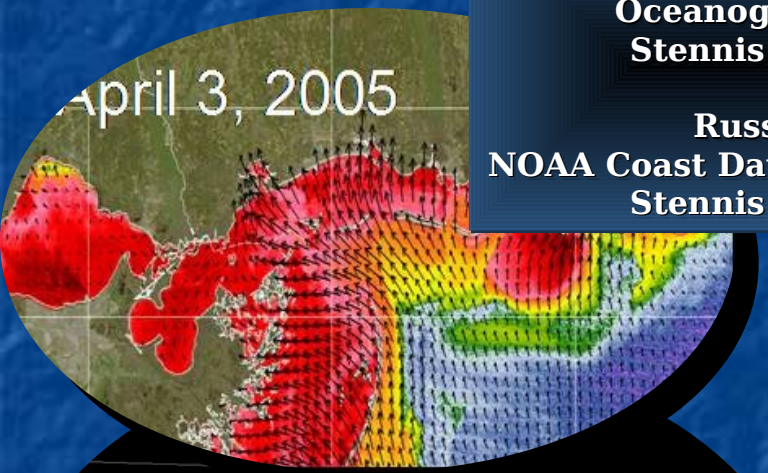
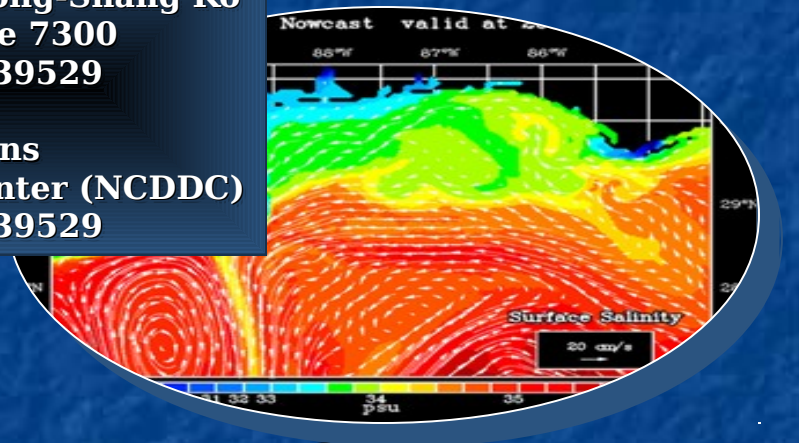
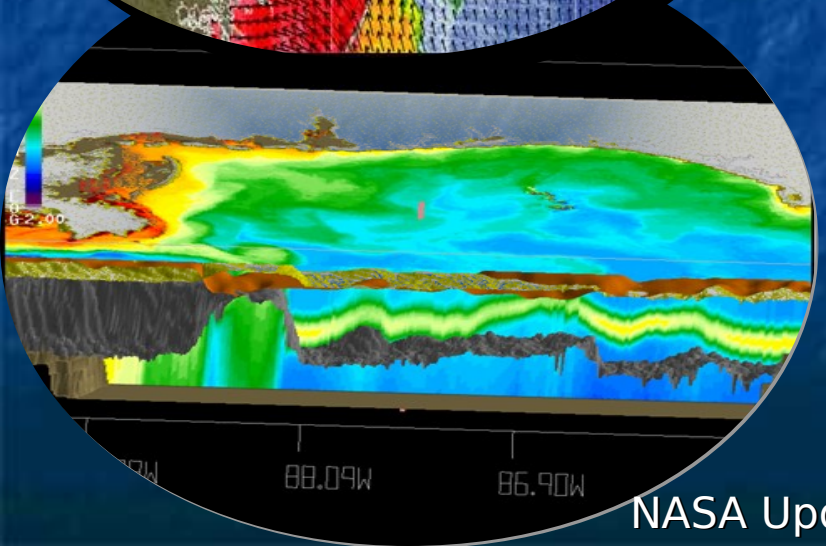
" Integrated Coastal Analyses" Demonstration Program in the Gulf of Mexico (REASoN)

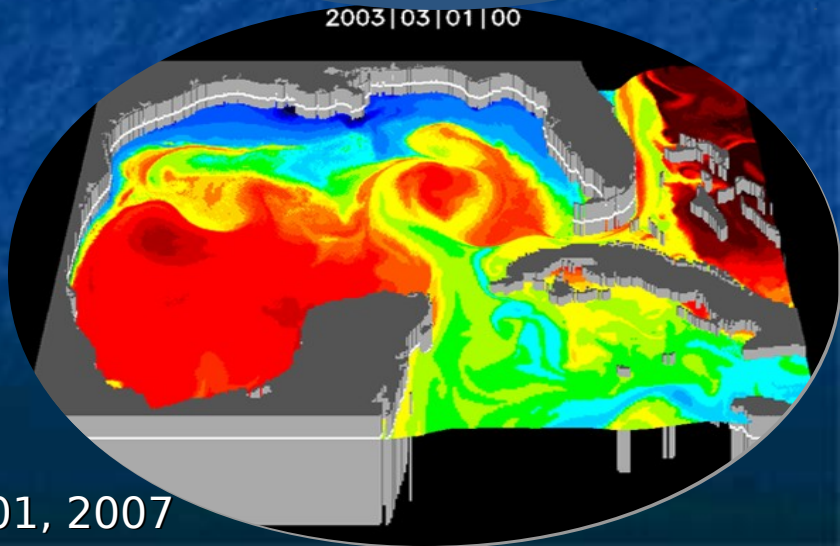
Robert Arnone, Brandon Casey,
Sherwin Ladner, Nita Sandidge, Dong-Shang Ko
Oceanography Division Code 7300
Stennis Space Center, MS 39529

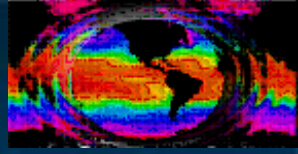
Russ Beard, Rost Parsons
NOAA Coast Data Development Center (NCDDC)
Stennis Space Center, MS 39529











REASoN Objectives:

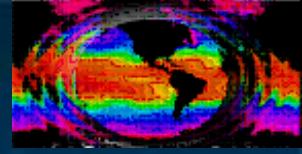
- NASA supported for "bridging research and opreaions" for Coastal Applications
- Establish environmental support products for the Gulf of Mexico
  - Demonstrate rapid access for monitoring ocean conditions
  - Automated data delivery and architecture for routine monitoring with ACT
  - Identify Metrics and product reliability and utility
  - Identify customers and applications through NASA and NOAA

- Demonstrate real time monitoring of ocean conditions
  - Remote Sensing of bio-optical and thermal ocean properties
    - MODIS (AM / PM)
  - Mode[illegible] ea[illegible] e[illegible] C[illegible] OM

- Identify new applicatio[illegible] of ocean products for monitoring coas[illegible]
  - [illegible]
  - [illegible] m[illegible] asing [illegible] itoring
  - Identify Customers with NOAA / NASA - Target Focus Areas
    - Harmful Algal Blooms
    - Fresh water Output - Hypoxia

Creating and real time "Ocean Weather" capability

Reaching the Customers....
A Starting Architecture



NASA Stennis MODIS Receive Site

NRL Remote Sensing Database

SST

Developmental Tools

NRL Modeling Database

NRL Internal

NRL External

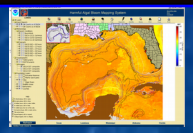
Limited Access

External Server
Gulf of Mexico
Revolving
30 Day real time

ACT Server
WIPE

NASA SSC Earth Science Applications

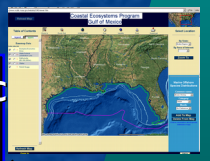
NOAA NESDIS National Coastal Data Development Center -SSC



NOAA NESDIS CoastWatch Program – DC

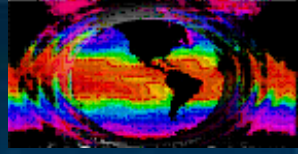
NOAA NOS Center for Coastal Monitoring and Assessment- DC

NOAA NOS / NCDDC Coastal Systems Center-Charleston



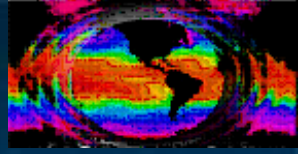
Mississippi Dept. Of Marine Resources (DMR)

Coastal Managers - Decision Makers



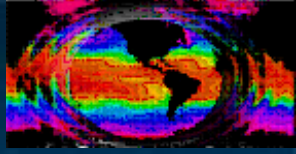
Program Focus

- Program Focus Areas
  - Harmful Algal Blooms (HABS)
  - Eutrophication
  - Coastal flooding / freshwater discharge
  - Hypoxia
  - Turbidity
  - Coral reef health
  - Shell Fish / Aquaculture



Update On Progress

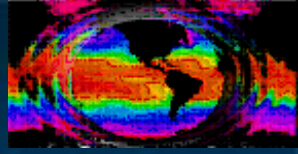
- Visited and Briefed DMR
  - Implementation of Fecal Coliform Algorithms (6)
  - Decision Making Tools
- Briefed NMFS
  - Larval Dispersion using Advection Scheme (Fish and Shrimp).
  - New Total Suspended Sediment Algorithms for MODIS 250m products.
  - Turbidity @ 250m.
- NOS
  - Processed, Converted and sent 3 Months of MODIS/SeaWiFS PCI formatted data files.
  - Multiple Products (CHL, Adg, Bb, At, Water Mass, Particle Size, etc.)
  - Anomalies will be generated for improvement in HABS detection bulletin.
  - Planning Future paper.
  - Similar effort along the North Carolina coast examining NRL 250 and 500m products.
- APS Upgrade (Enhanced / New Optical Algorithms)
- EPA
  - New Real-Time Animation of the Veracruz, NM region of the Gulf of Mexico -> HABSOS
- New Products to NCDDC (DMR, NMFS, EPA, Hypoxia Watch, HABSOS, etc.)
  - Water Mass Classification – Hypoxia Applications
  - Salinity from Ocean Color – DMR, EPA, NMFS, FDA
  - Total Suspended Sediments (250m) – NMFS
- New Research (Fusion of Satellite and Modeled Properties)
  - 3d Optical Fields Forcasting
  - Optical Properties – Prediction of tomorrows image 24 hours in advance.



Future Presentations & Publications

- Abstract submitted to the Journal of Applied Remote Sensing titled, “Ocean Monitoring in the Gulf of Mexico – Linking real-time circulation models and satellite bio-optical properties.” Future Publication.
- Paper in Press for the Journal of Food Protection titled, “An evaluation of the use of remotely sensed parameters for prediction of incidence and risk associated with Vibrio parahaemolyticus in Gulf Coast Oysters (Crassosstrea virginica)”.
- Future Presentation/Publication with NOS (Rick Stumpf) on using optical anomaly fields to better enhance HAB predictions.
- Future publication on the research project to the news article.
- Hypoxia Summit Presentation.

Two Sets of real-time Monitoring Products



Satellite products :

Time

MODIS – Terra –SST /Ocean Color
MODIS – Aqua – SST /Ocean Color
2 scenes / day

Products

RRS – 412, 443,490,510,555,670 K532
Chlorophyll (OC3m, Carder) absorption
(total, λ) (A, C,QAA)
aphi443 (Carder, OAA, Gould, Stumpf) adg412 (Carder, QAA, Stumpf)
adg443(Carder, QAA,) ad412 (Gould)
acdom (Gould) bb555
(Arnone, Carder, QAA)
Turbidity C648 (Gould) c670 (Carder)
Horizontal Vis (QAA, Arnone) Vertical Vis
(QAA, Arnone)
Particulate Organic matter Particulate
Inorganic Matter (Gould)
ag443(Gould)
Total Sus Sed (Gould) Water Mass (Gould)
Cloud Albedo L2 Flags
True Color Salinity
250M – True Color c670 (G&A)
SST PAR

Circulation products :

Physical Ocean Models –
Navy Coastal Ocean Models (NCOM)

- **Nowcast – 12, 24 ,48 hour forecast**

Dong Ko et al

- Resolution 6 km
- 41 hybrid sigma/z levels
- River fluxes (non-real time)
- Driven by wind fields and heat fluxes

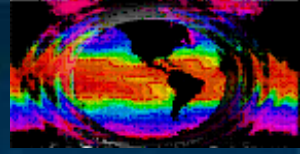
Products

- salinity,
- velocity

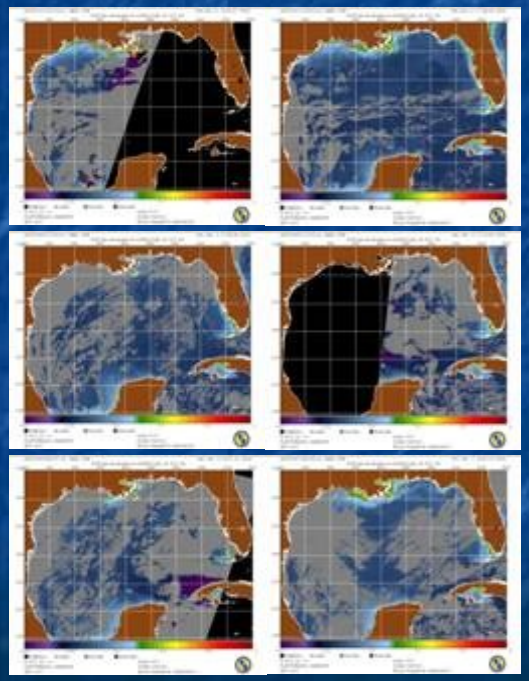
Assimilation
Altimetry SSH
SST – (9 km) (
1km)
Synthetic BT (

Daily Products
Total
Satellite – 426
Model - 800
122

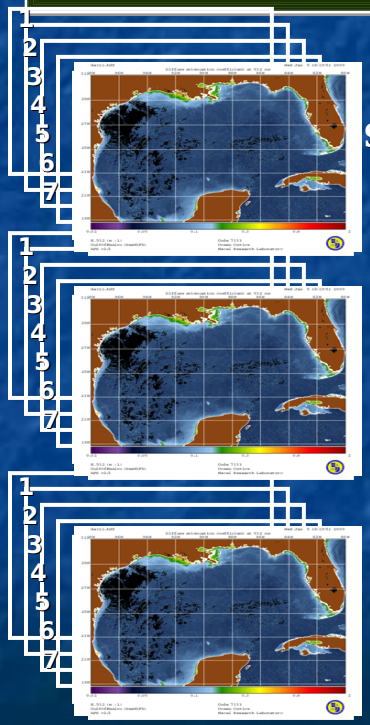
MODIS Terra / Aqua, and SeaWIFS*
Near Real-Time *(2-4 hours)*



Level 3
Calibrated, Atmospheric Correction, Geophysical Product
Geo-registered,
daily composites
1 km resolution



Level 4
Latest Pixel Composite
Weekly, Monthly
1 km

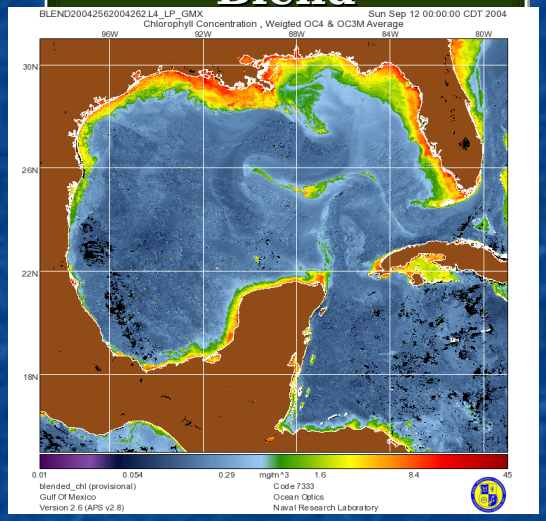


SeaWIFS*

MODIS Terra

MODISAqua

Level 4
Latest Pixel Composite
Blend



Daily product of the Latest Pixels

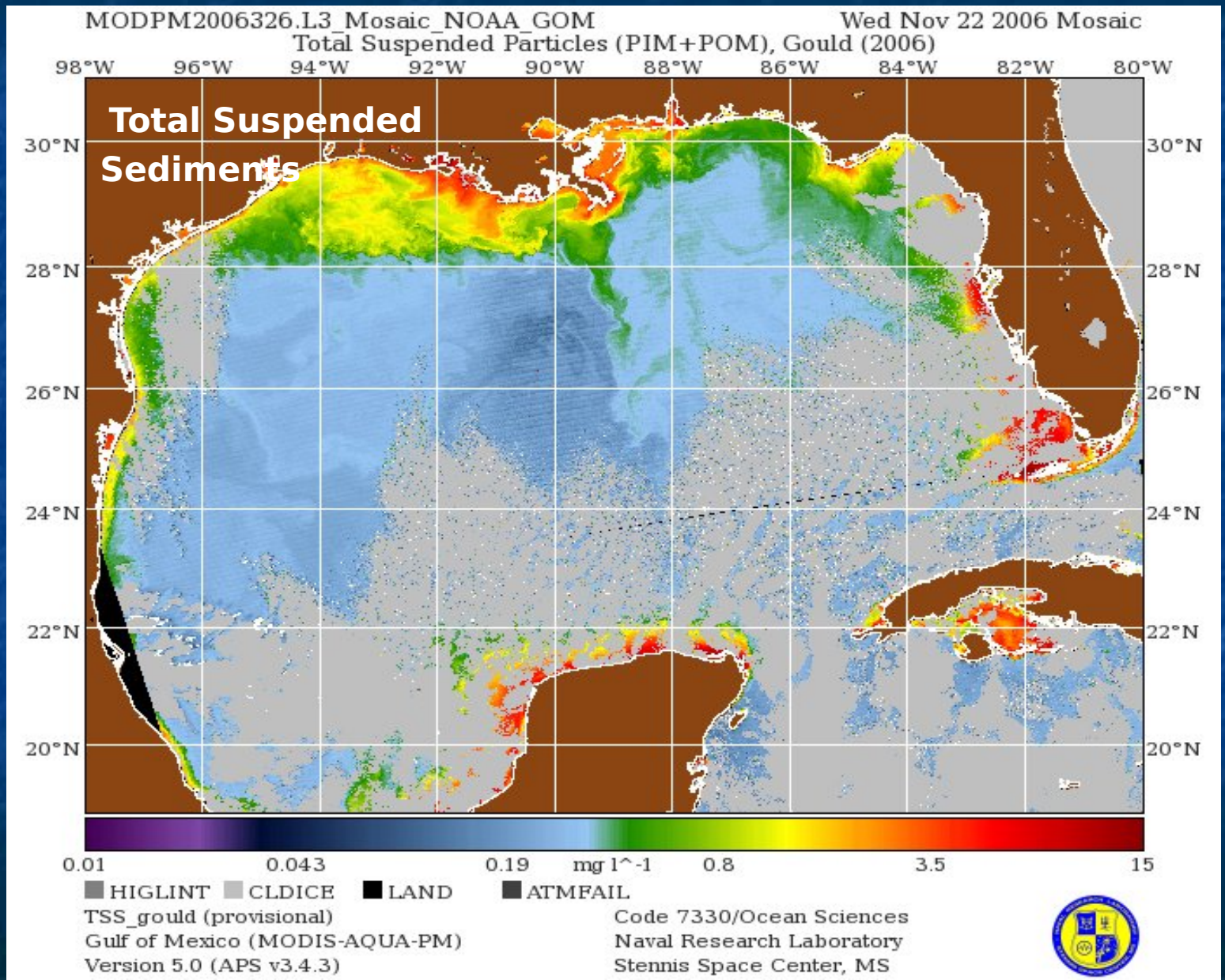
- **Chlorophyll**
- **atotal 443**
- **adg**
- **bb555**
- **aphi**
- **sst day**
- **sst night**

New products
Anomaly Fields
Salinity
3d- chlorophyll
PAR
Water Mass
TSS

* Not distributed (R&D Assessment)

Examples of Daily MODIS 1KM Products

November 22, 2006

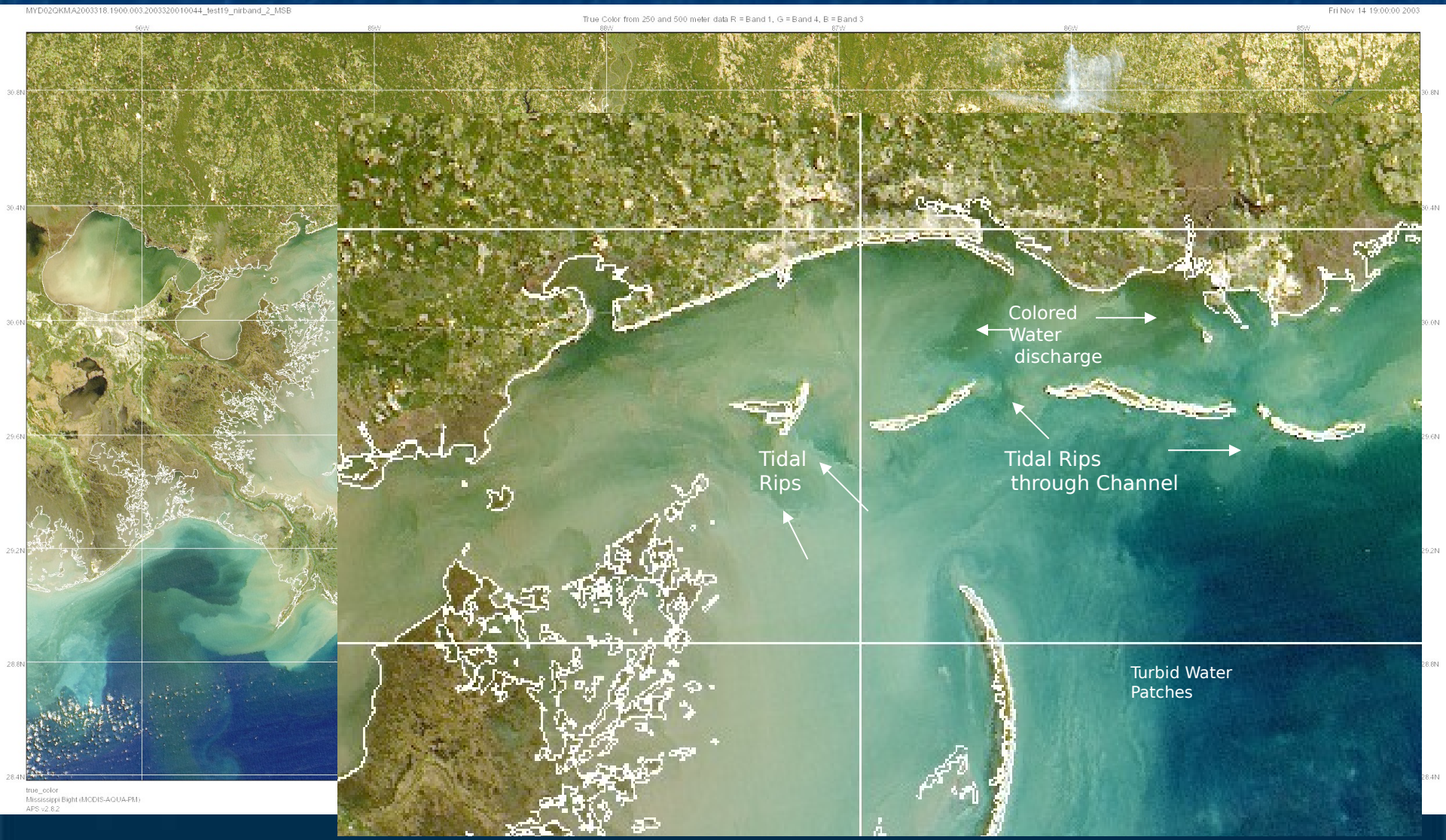


Coastal Applications

Improved MODIS – 250m products

Location of “turbid water” fronts → Fisheries and Oyster reef management

Ship sampling – management

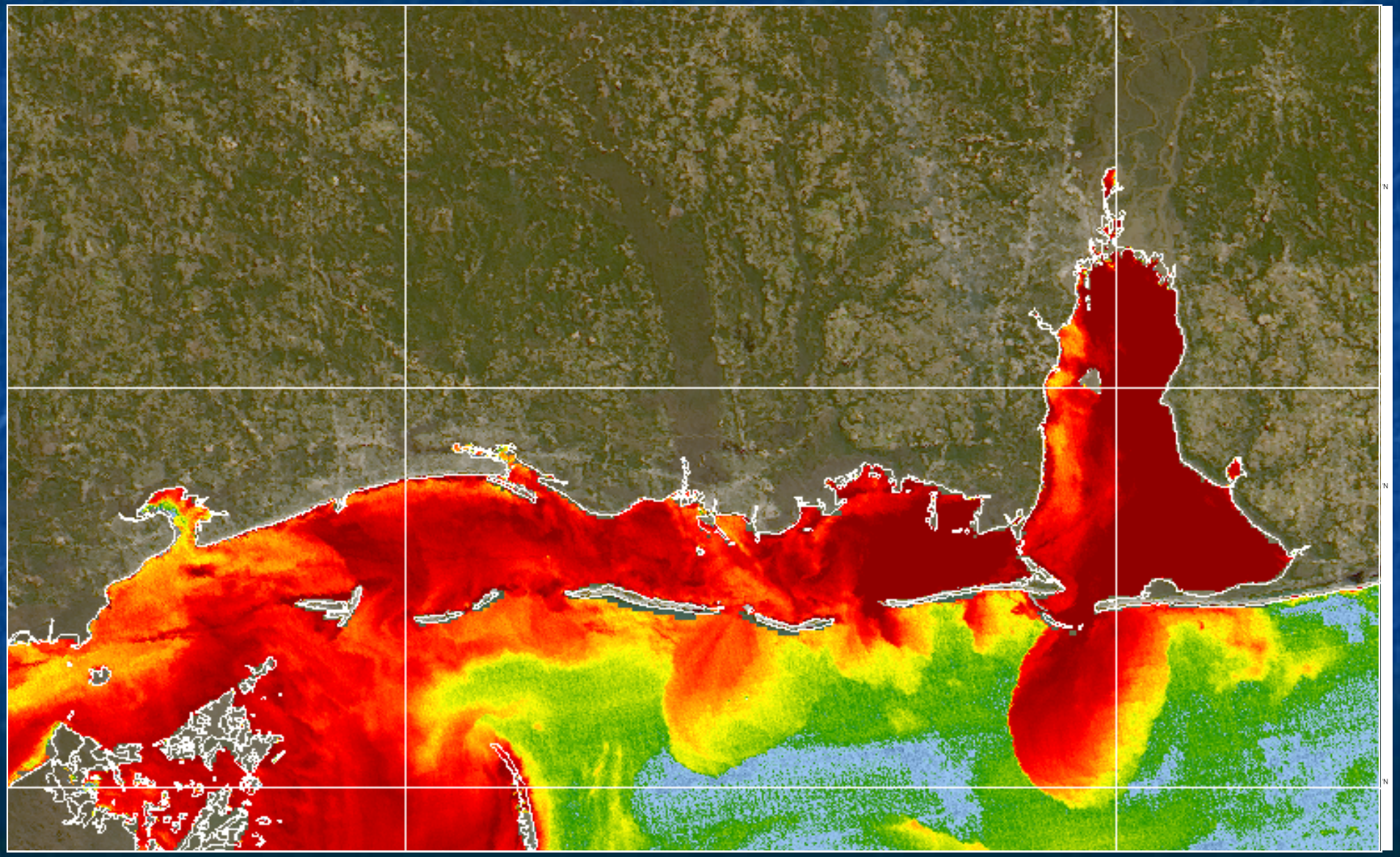


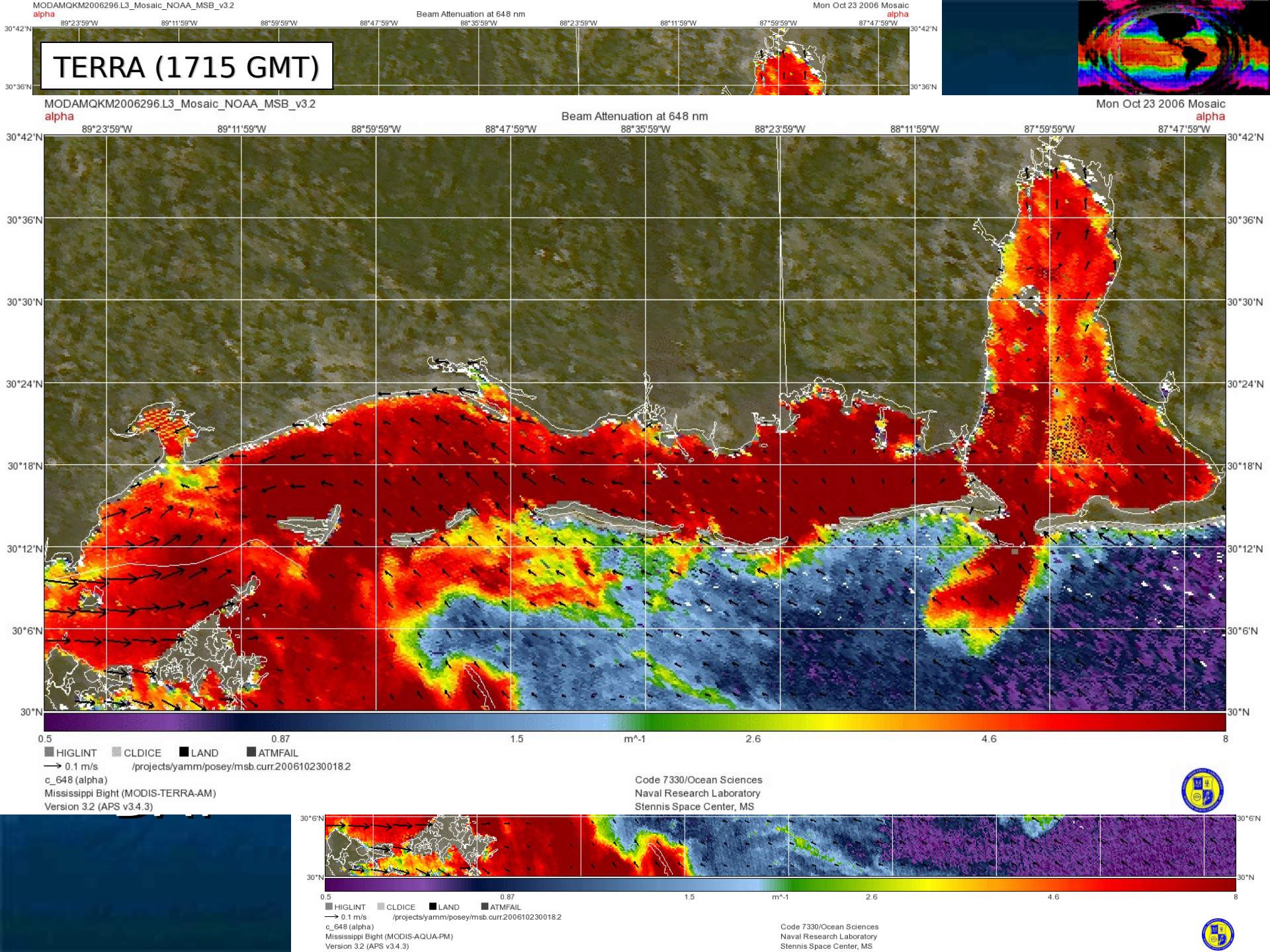
250m MODIS – Terra – Nov 14, 2004

Rayleigh corrected and Edge sharpening

Examples of Daily MODIS 250m Products

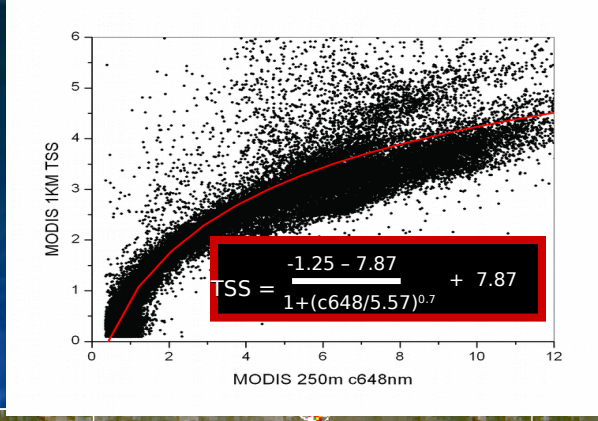
November 22, 2006




TERRA (1715 GMT)
MODAMQKM2006296.L3_Mosaic_NOAA_MSB_v3.2
alpha
Beam Attenuation at 648 nm
Mon Oct 23 2006 Mosaic
alpha
89°23'59"W
89°11'59"W
88°59'59"W
88°47'59"W
88°35'59"W
88°23'59"W
88°11'59"W
87°59'59"W
87°47'59"W
30°42'N
30°36'N
30°30'N
30°24'N
30°18'N
30°12'N
30°6'N
30°N
0.5
0.87
1.5
m^-1
2.6
4.6
8
HIGLINT
CLDICE
LAND
ATMFAIL
0.1 m/s
/projects/yamm/posey/msb.curr.200610230018.2
c_648 (alpha)
Mississippi Bight (MODIS-TERRA-AM)
Version 3.2 (APS v3.4.3)
Code 7330/Ocean Sciences
Naval Research Laboratory
Stennis Space Center, MS
Mississippi Bight (MODIS-AQUA-PM)
Version 3.2 (APS v3.4.3)

MODIS TSS Products

MODIS AQUA
October 28, 2006
1910 GMT



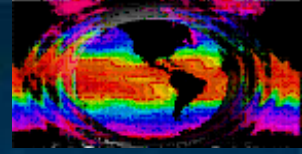
TSS (mg/l)
0.7 1.3 2.1 3.0 3.9

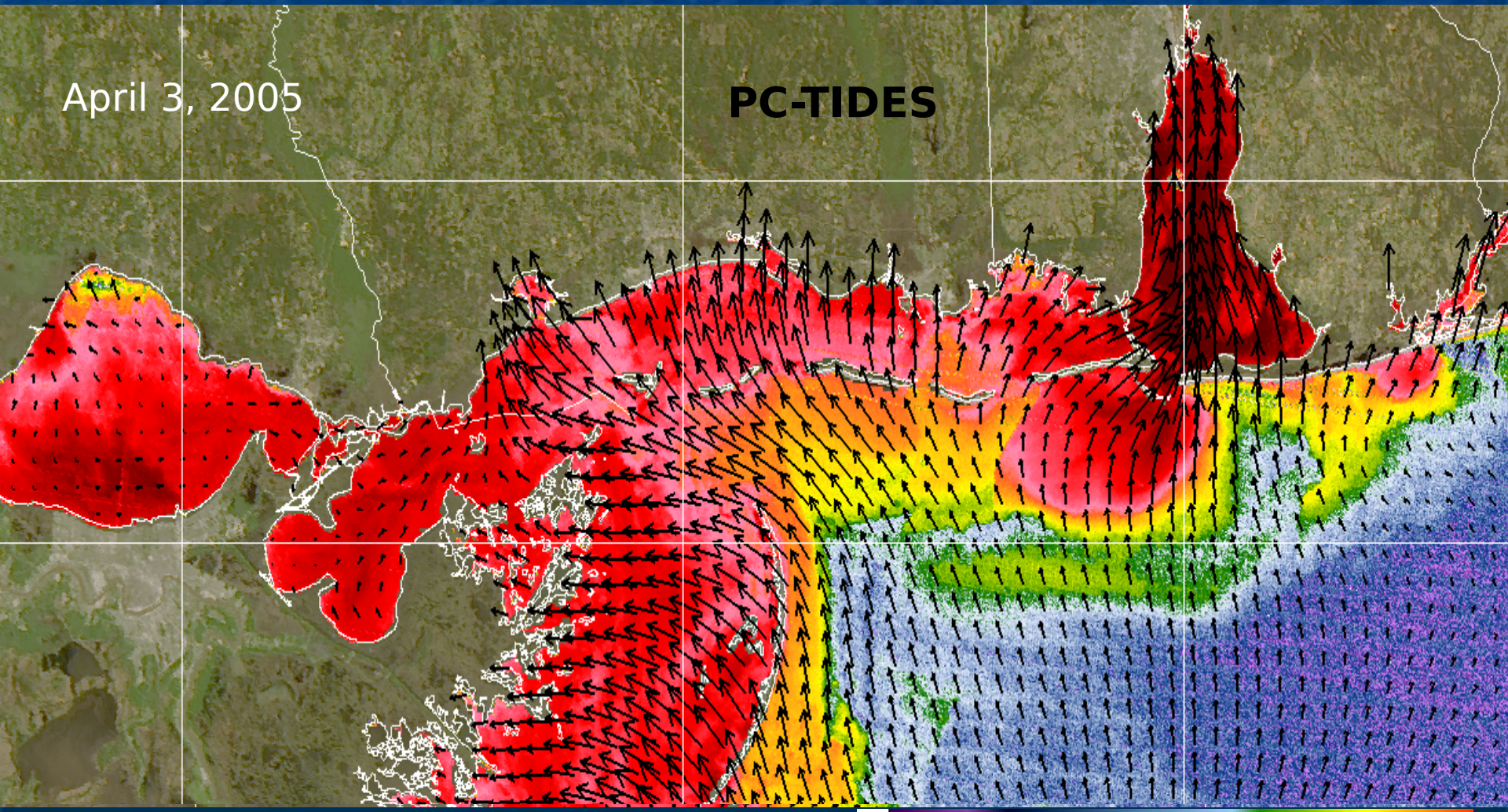
Preliminary
250m

BeamC (c) = Absorption (a) + Scattering (b)

TSS is proportional to & derived from b

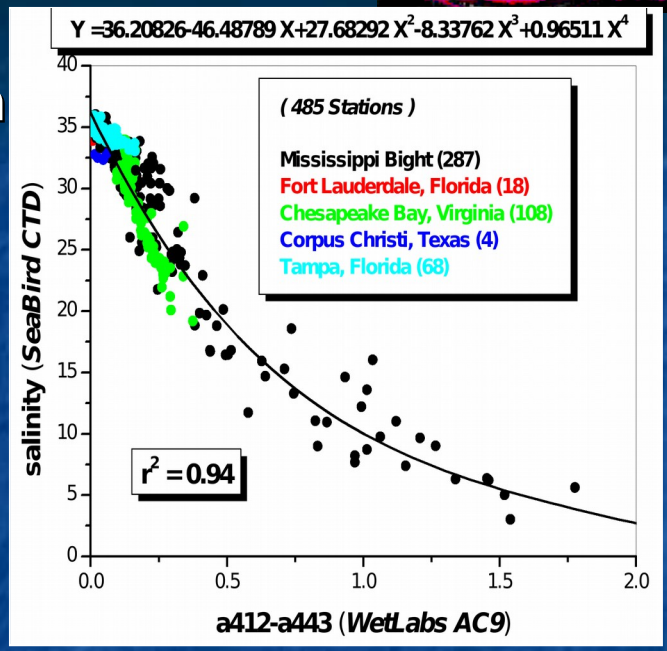
MODIS – 250m products
Monitoring Coastal processes

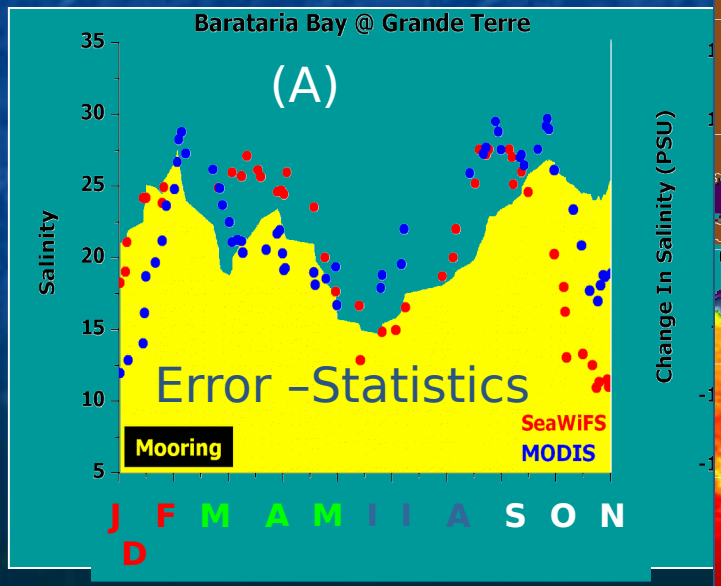


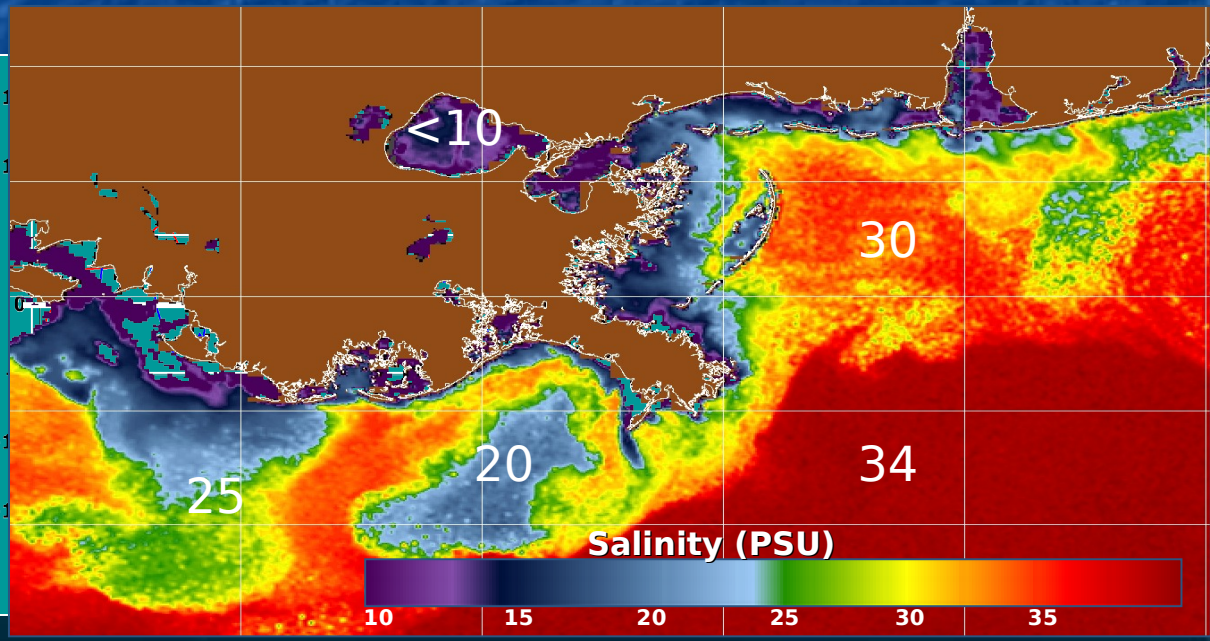


sing Ocean Color Imagery to Monitor Salin

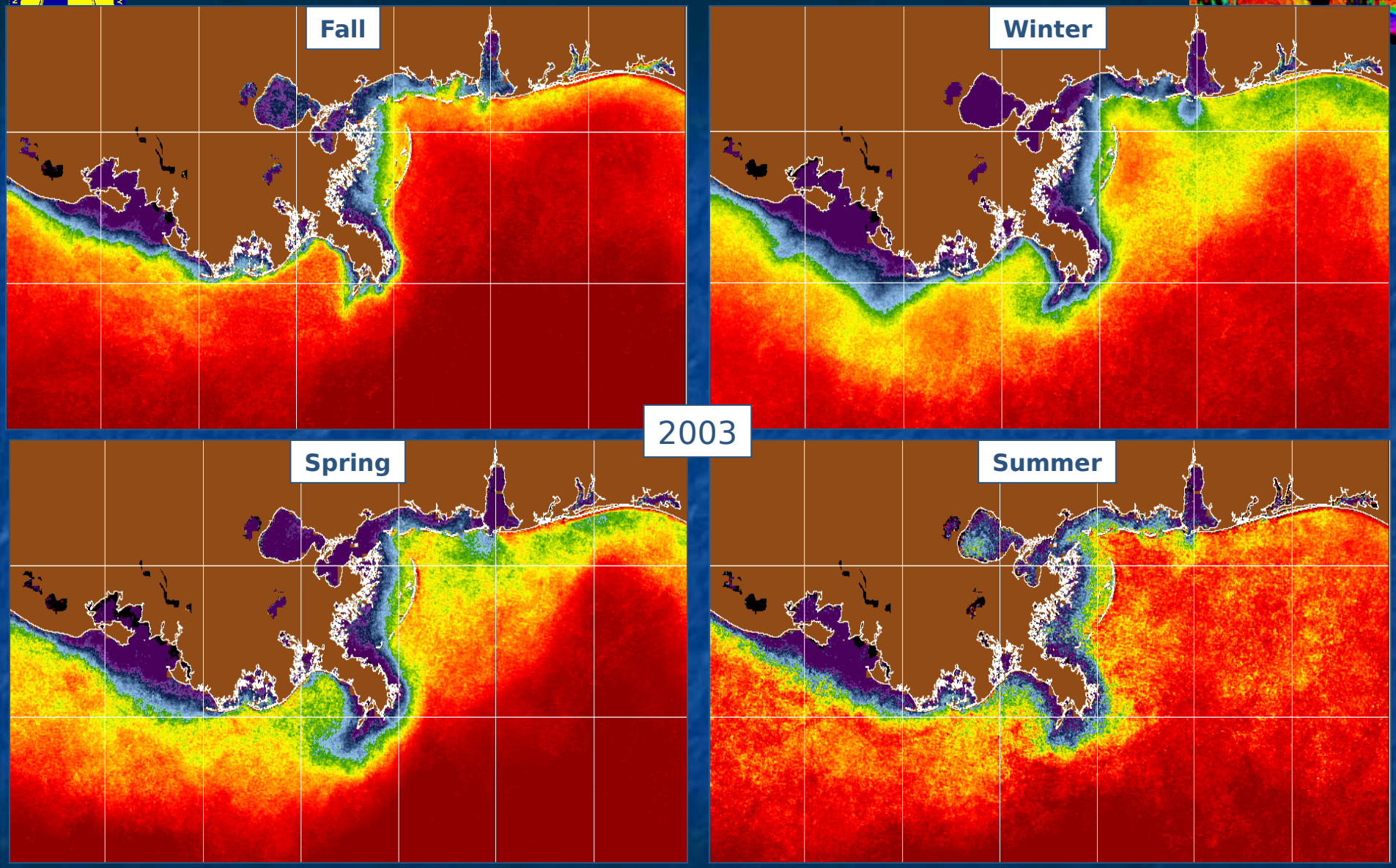
eveloped new ocean color algorithms
or retrieving surface salinity in coastal areas
Defines extent of river plumes and coastal
runoff





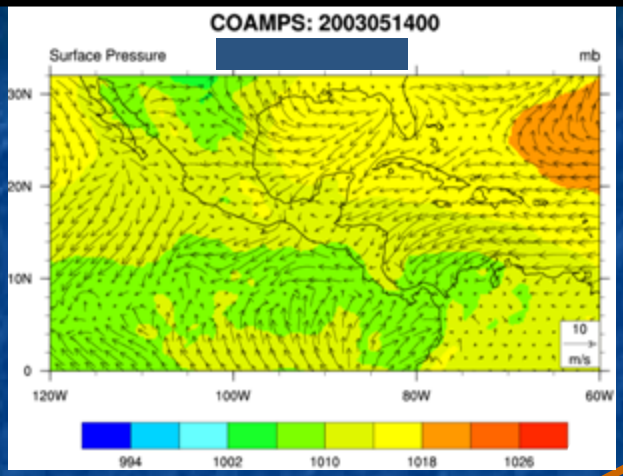


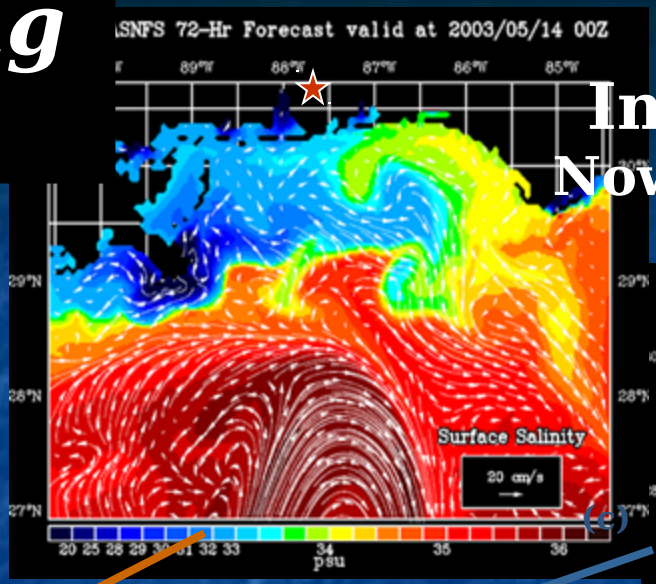
Seasonal Trends in Satellite Derived Salinity

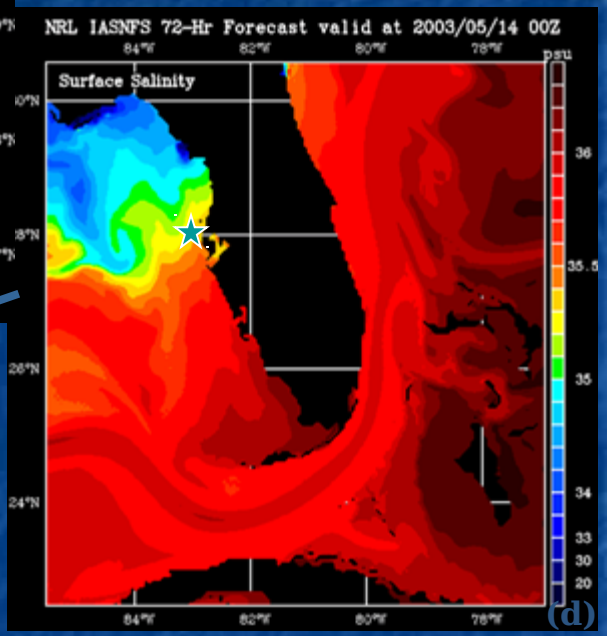


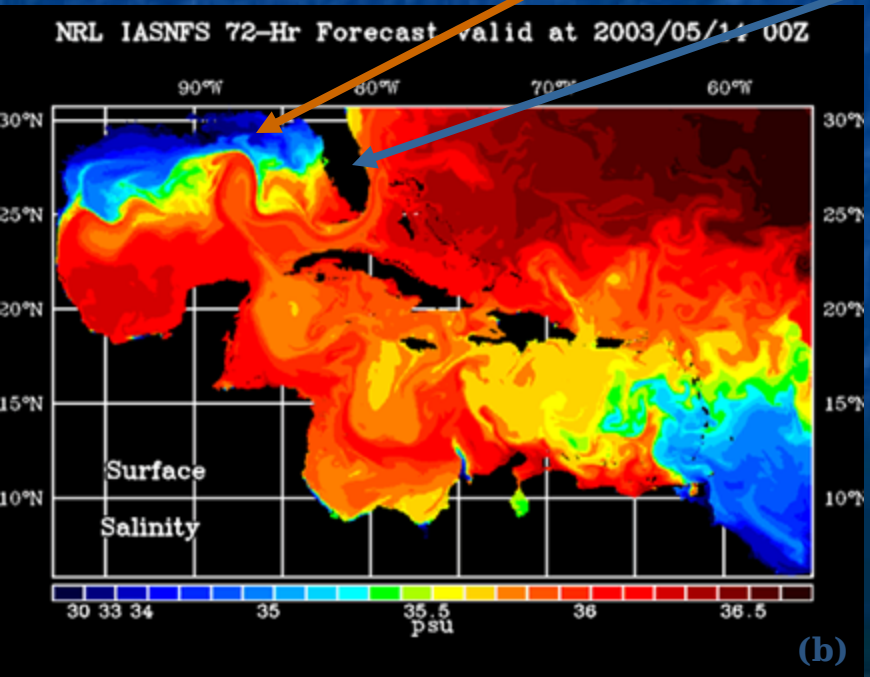
oastal Modeling Forecasting

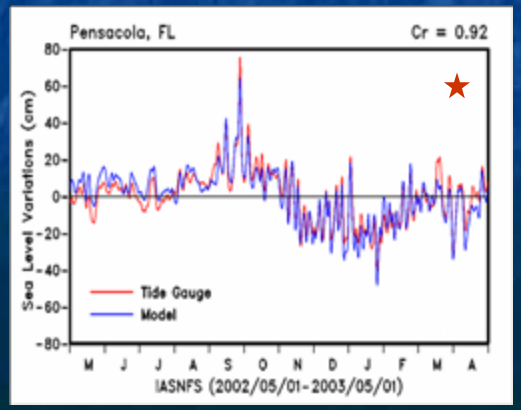
Intra-Americas Se
Nowcast/Forecast Syste

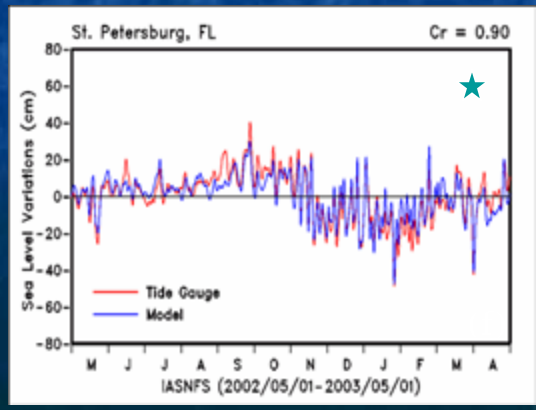






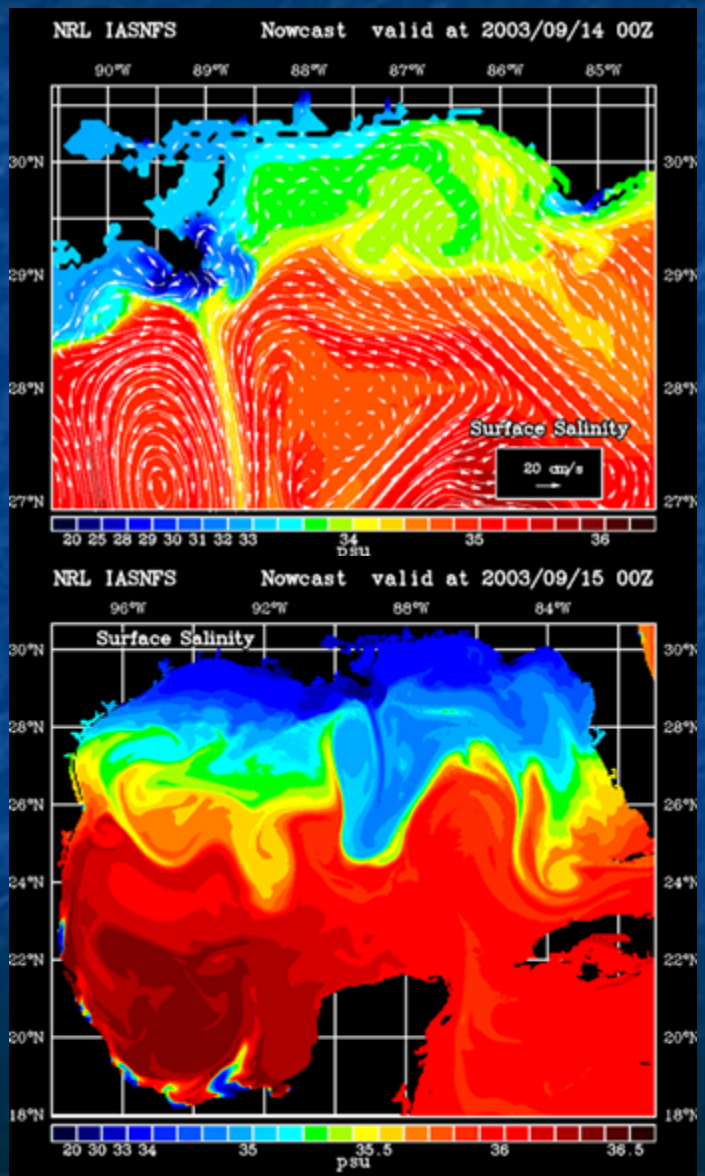




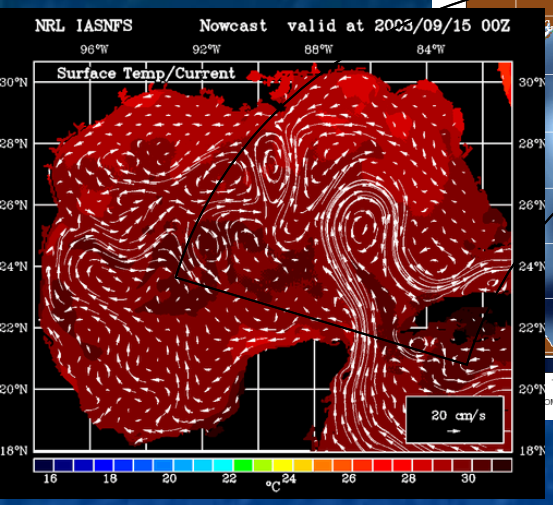


NRL NCOM Model Characteristics

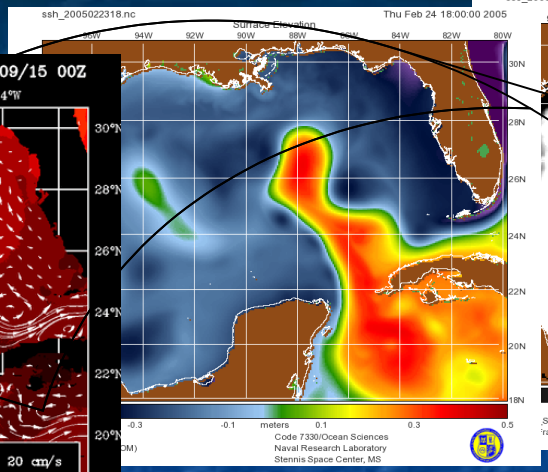
- **IAS NCOM Model**
  - Resolution 6 km
  - 41 hybrid sigma/z levels
  - Data assimilating
  - Driven by wind fields and heat fluxes
- **Products**
  - Temperature, salinity, currents, sea surface height
  - 48 hour forecast



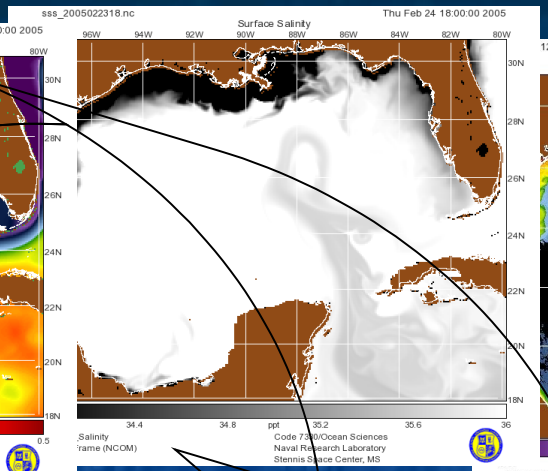
Fusing the Satellite Optical Products and Physical Models



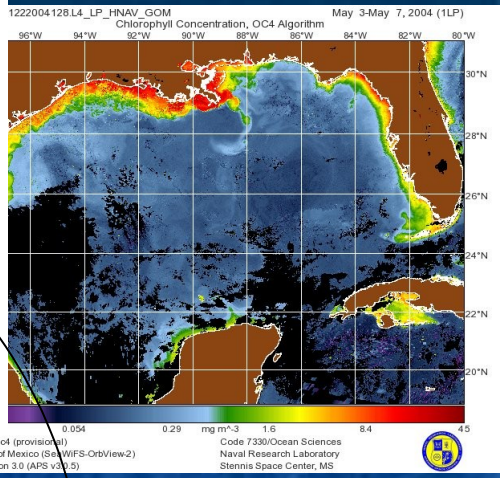
Currents – NCOM
"Intra Americas Seas"



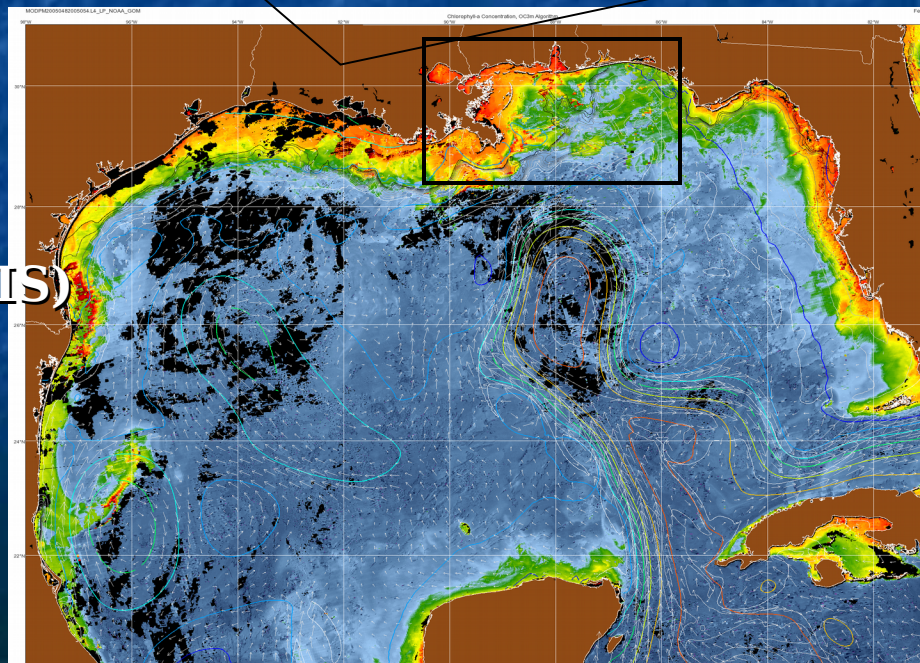
SSH– NCOM



Salinity



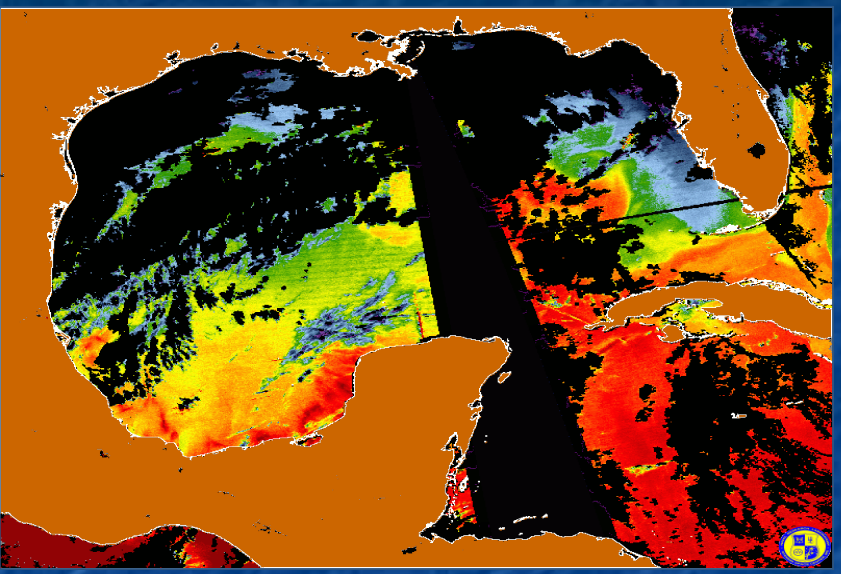
SeaWIFS, MODIS Chlorophyll
Absorption, Scattering, Photic Depth etc



val Coastal Ocean Model (NCOM)
Vertical layers,
nd Forcing (CAMPS)
imilation of Altimetry and SST (MODIS)
ver inputs →Climatology

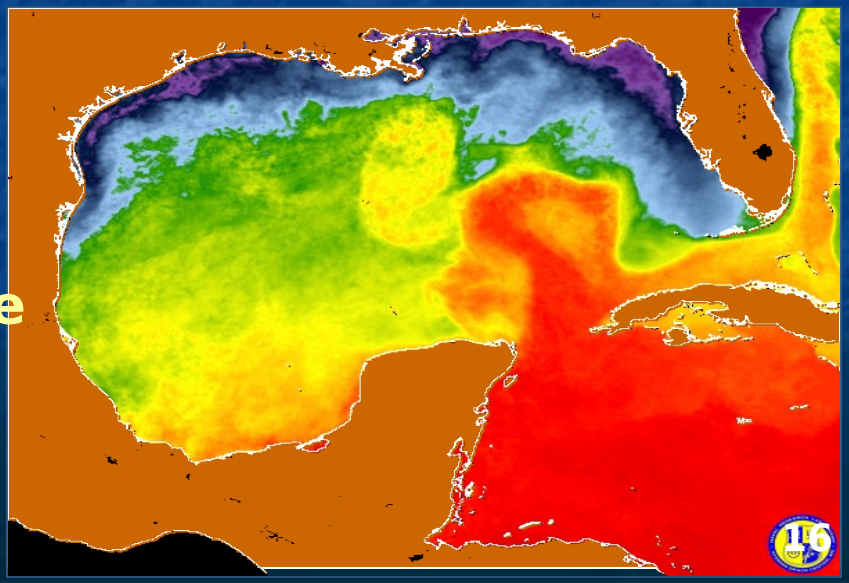
rface View Only

Enhanced SST Product Combining Model and MODIS SST



Daily MODIS

Mar. 10, 2006



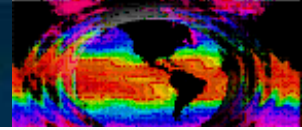
Composite SST

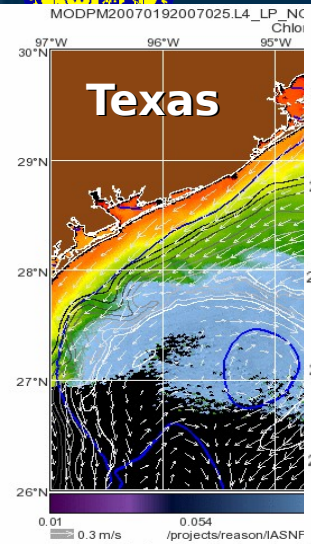
- Removed Clouds
- MODIS derived SST is integrated with AVHRR analyses
- *Benefits*:
  - Increases SST data available for the analysis (spatial coverage of satellite data)
  - Resulting field at higher resolution than operational SST products

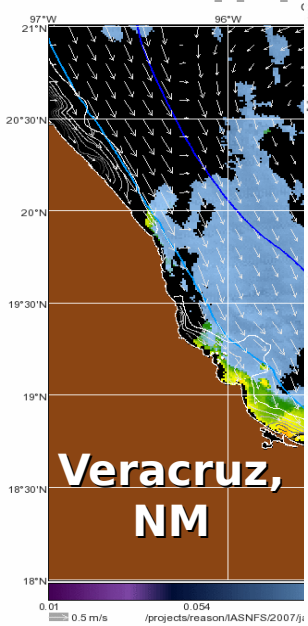
Degrees C

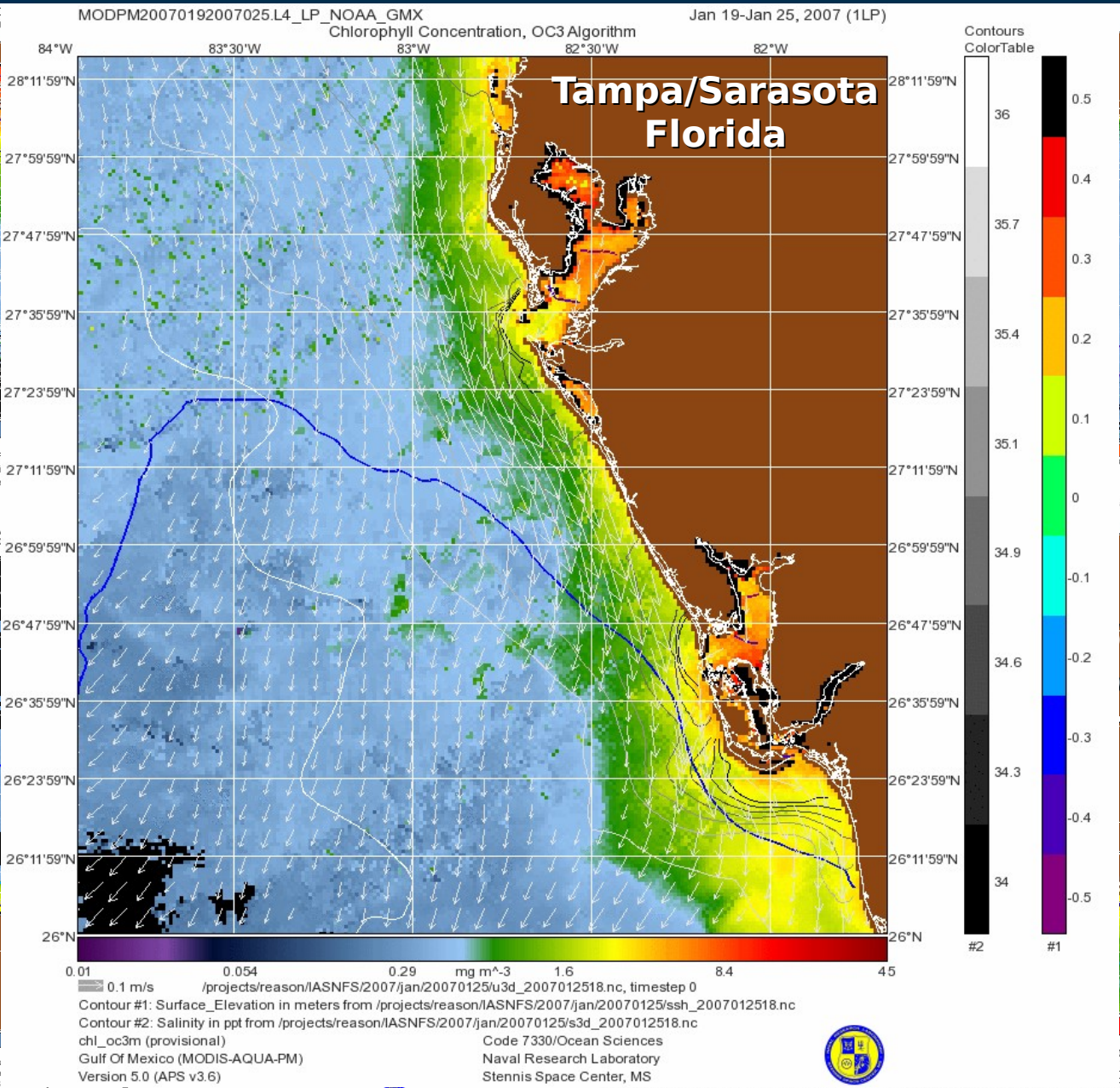
18.4 20.8 23.2 25.6 2

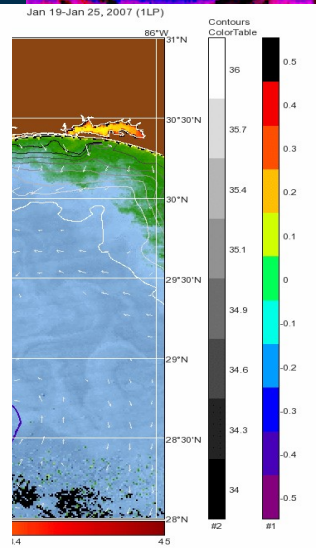
Real- Time Fusing of Remote Sensing With Ocean Models

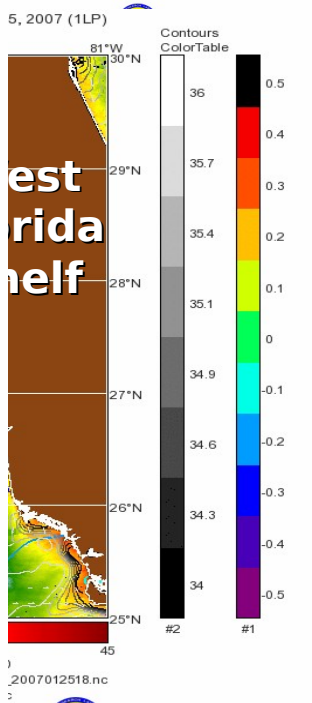










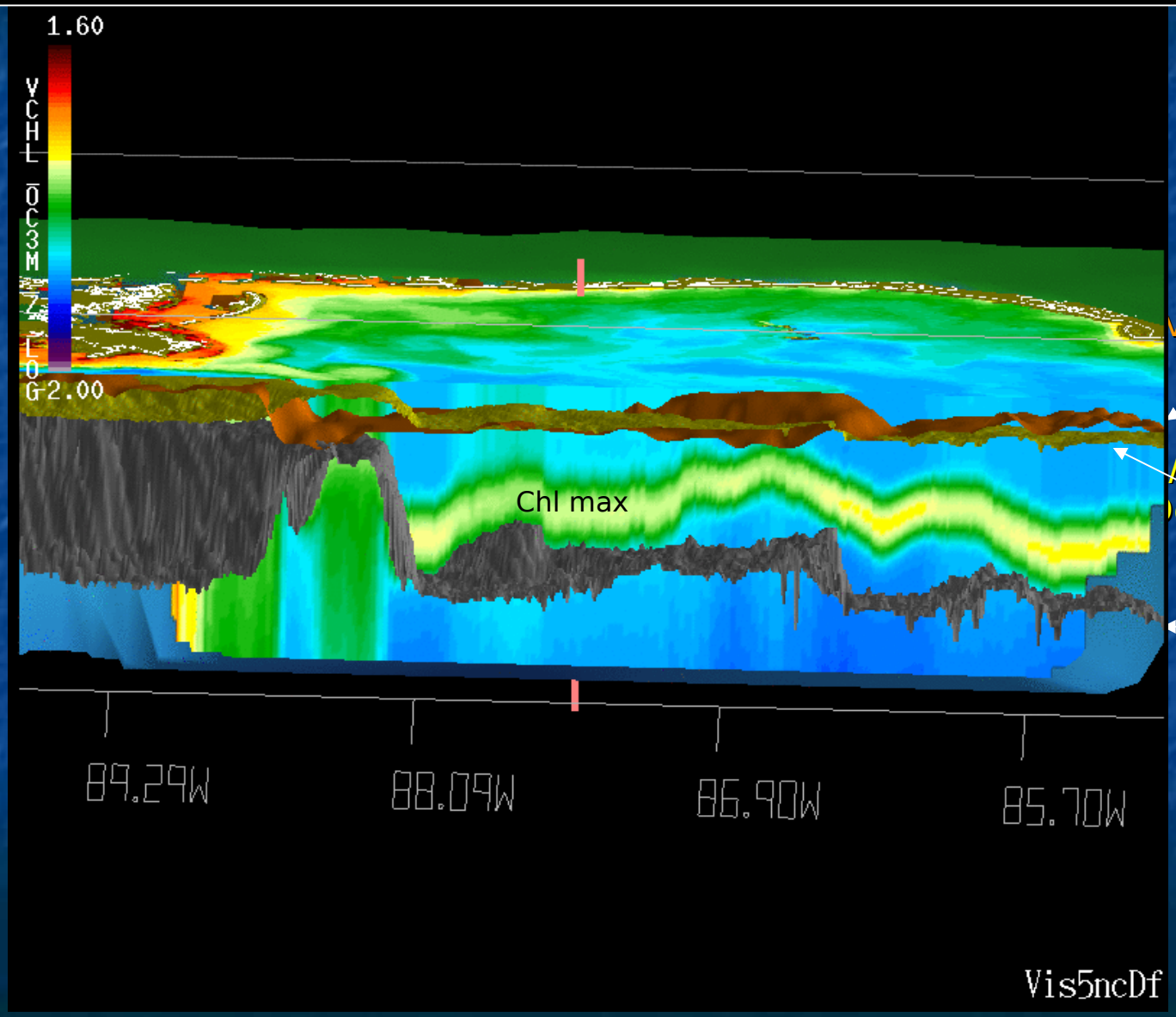


Code 7330/Ocean Sciences
Naval Research Laboratory
Stennis Space Center, MS

chl_oc3m (provisional)
Gulf Of Mexico (MODIS-AQUA-PM)
Version 5.0 (APS v3.6)

Code 7330/Ocean Sciences
Naval Research Laboratory
Stennis Space Center, MS

Deriving the subsurface structure beyond the satellite observations



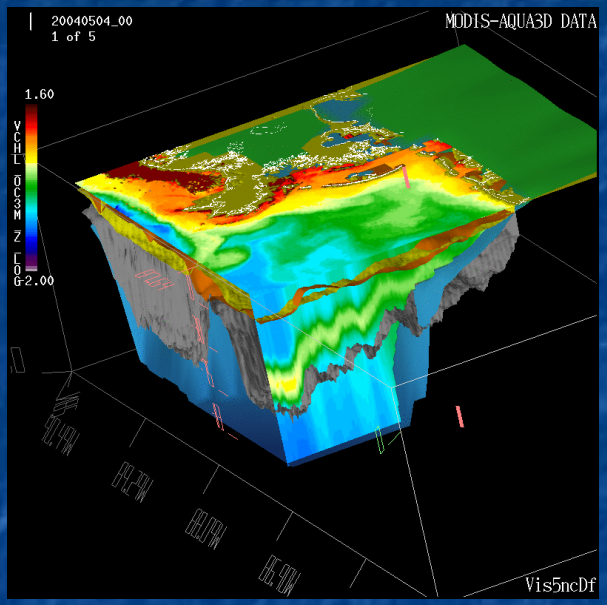
Surface Chlorophyll
Extended vertically

Mixed Layer Depth (m)

/k –Satellite Penetration
epth

Photic Depth

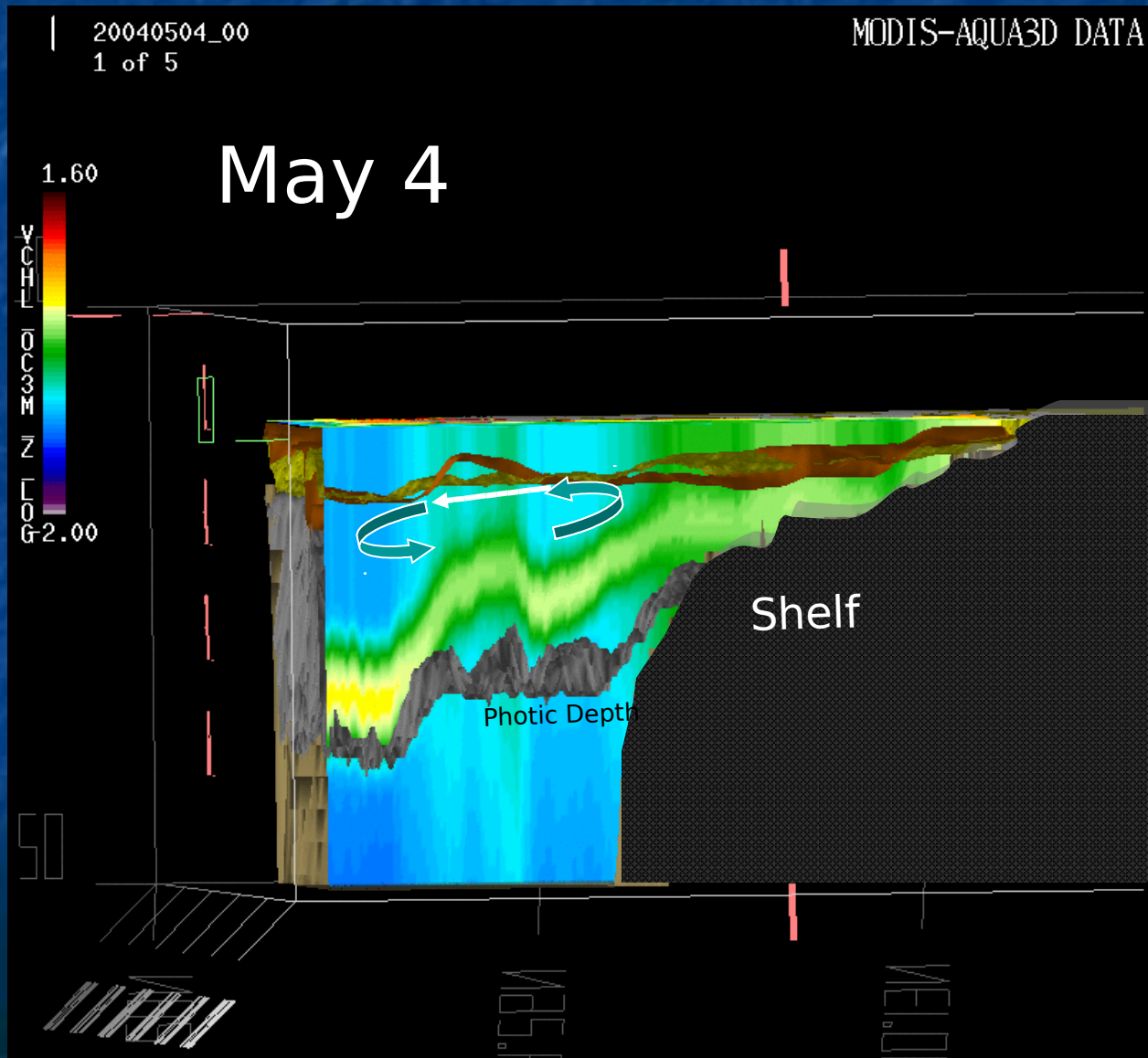
Subsurface Chlorophyll Properties by combining Satellites And Models



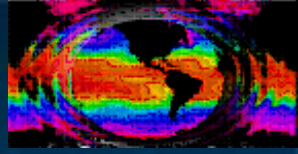
3d chlorophyll
Going real time -
Summer 2006

Movie May 4

Movie May 6



Forecasting Satellite Imagery / Optics



Seed the Model with Particles from MODIS March 1, 2006,

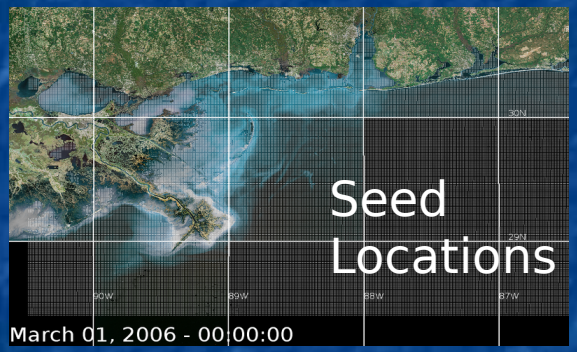
Advect the particles forward Hourly steps Conservative tracers

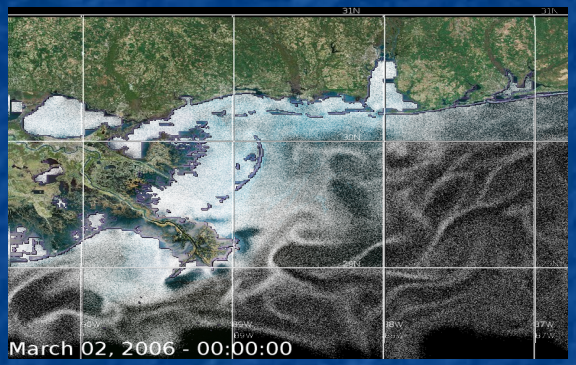
Compare with MODIS March 2, 3, 2006

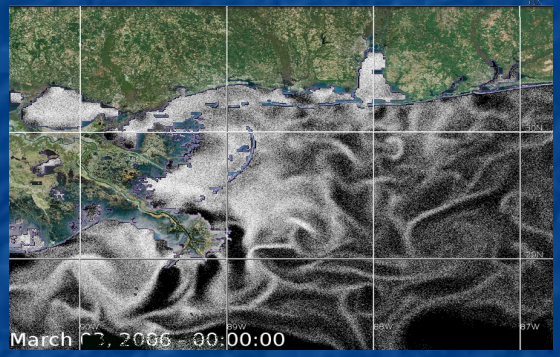
March 1, 2005 Backscatter Seed

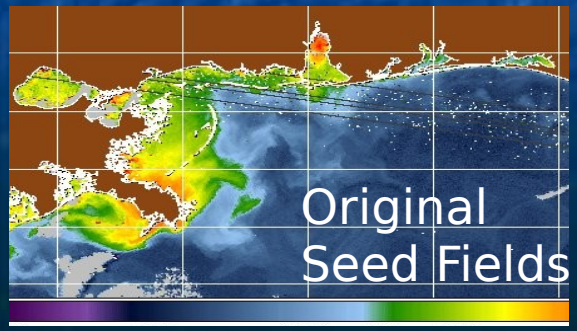
24 hour forecast March 2, 2006

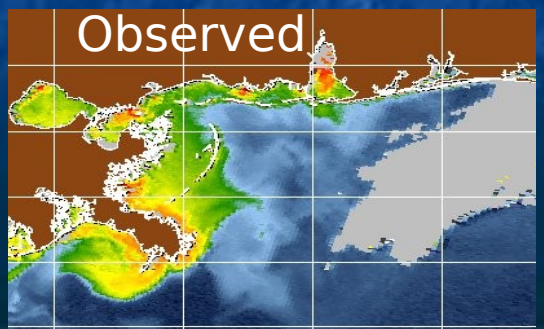
48 hour forecast March 3, 2006

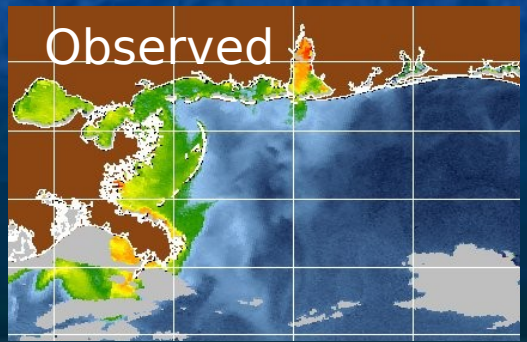




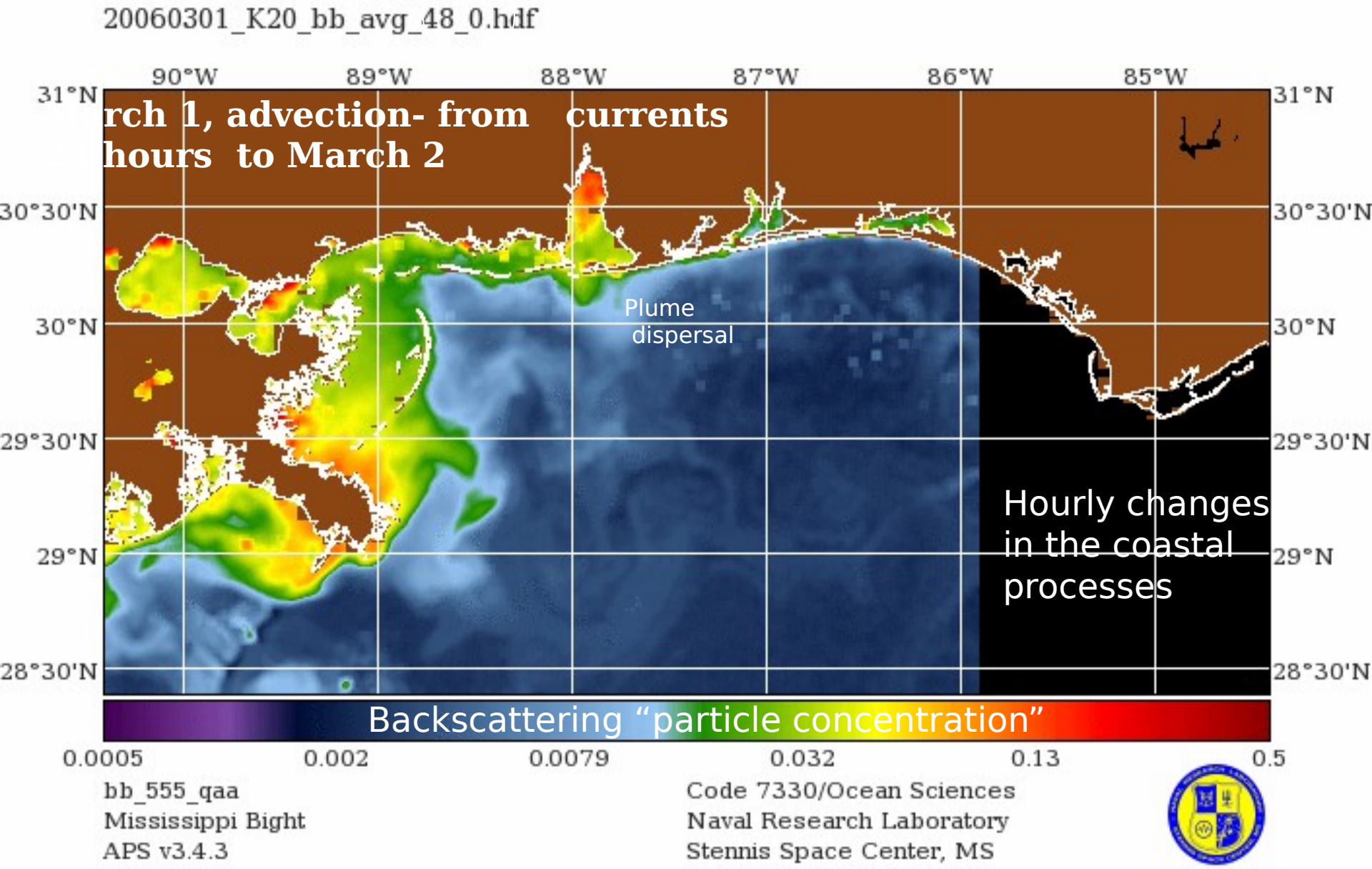




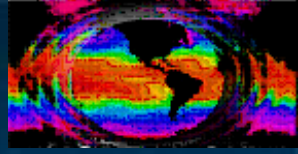




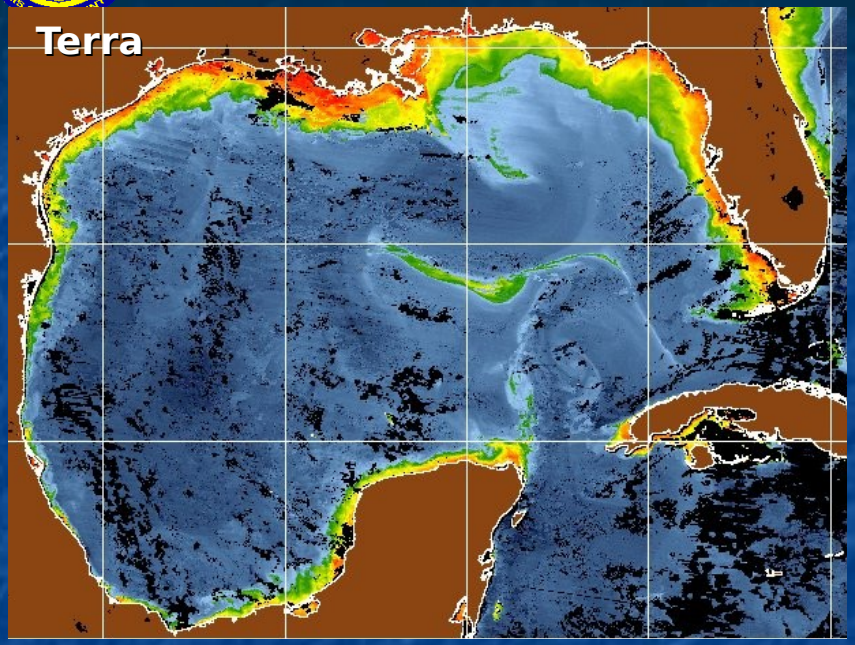
Monitoring Coastal process
upling Ocean Models with MODIS satellite pro



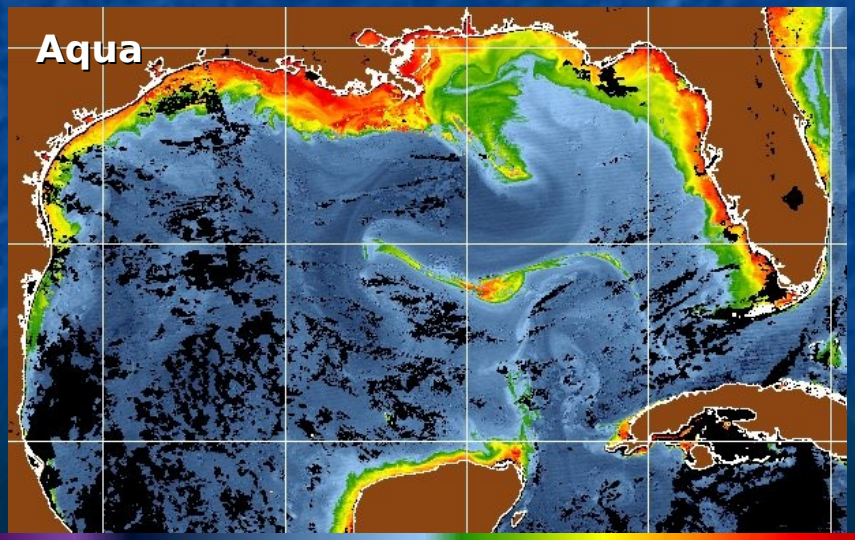
Blending the "Latest Pixel Composite" from each satellite each day



Terra

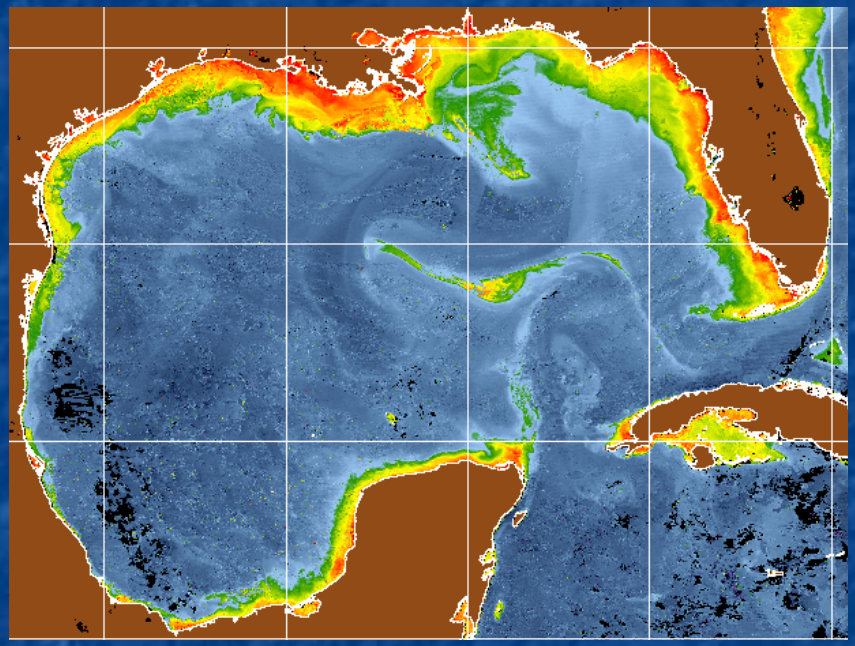


Aqua



September, 19 2004

Daily Bended

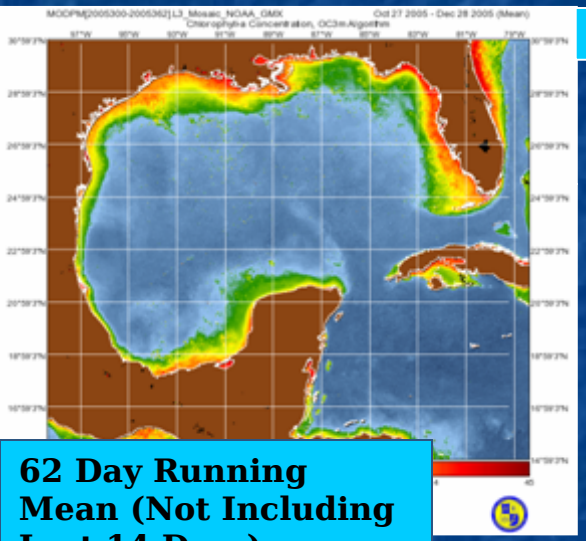


Chl-a (mg/m³)

.01 .054 .29 1.6 8.4

New Products on NRL Server in January 2006

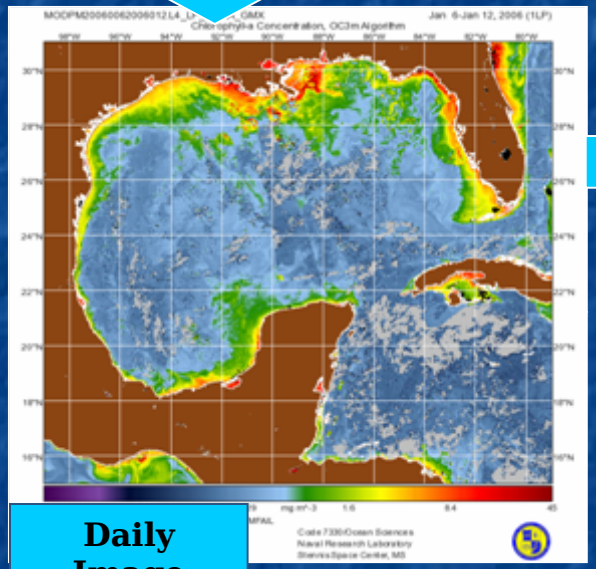
Analyzing Image-derived Anomalies



62 Day Running Mean (Not Including Last 14 Days)

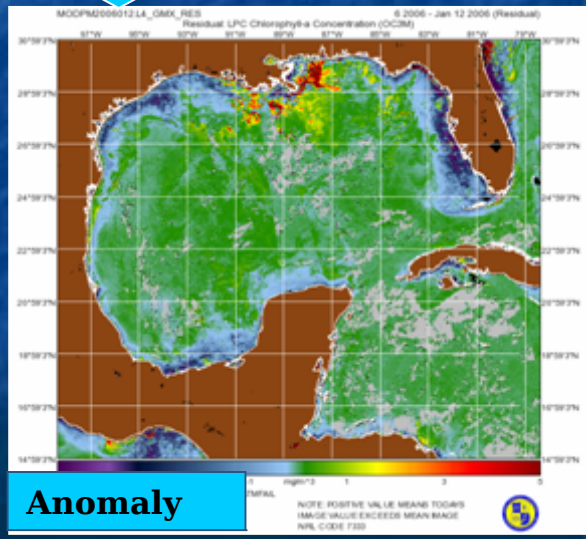
Subtract

Determining the Anomaly field:
[Mean – Daily = Anomaly]



Daily Image

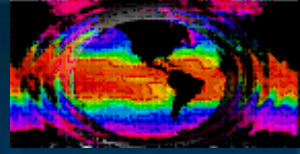
Anomaly



Anomaly

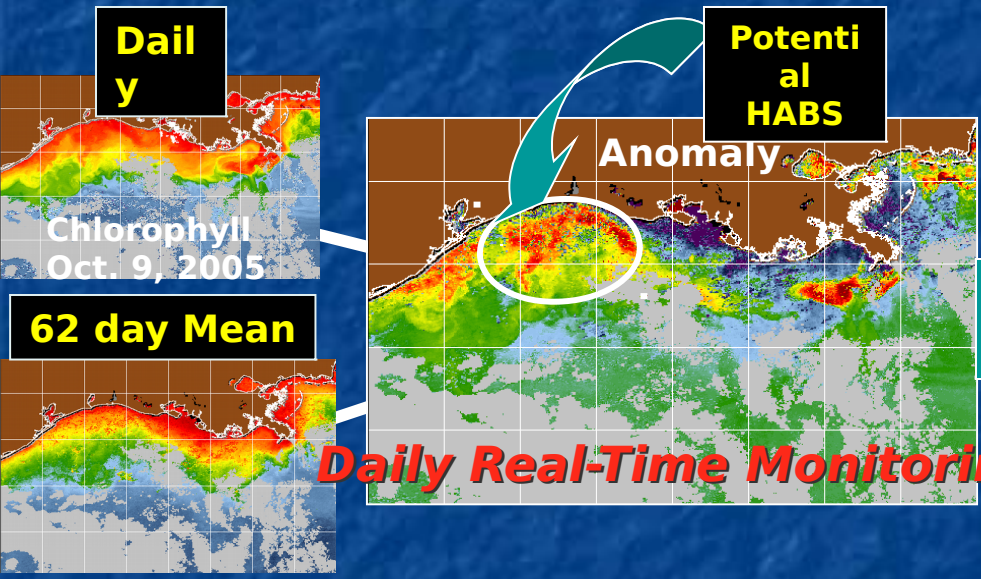
NRL is producing anomaly fields of chlorophyll concentration, backscatter, CDOM, and total absorption to highlight coastal areas where anomalous conditions exist. Anomalies calculated following NOAA NOS (Stumpf). Such anomalies may indicate regions where coastal

Harmful Algal Bloom (HAB) Monitoring



Targeting - Possible HARMFUL from non-HARMFUL ALGAL
Supporting Ship Sampling regions measurement programs
Assessing Size, Location and Movement of "Bloom"

MODIS PRODUCTS

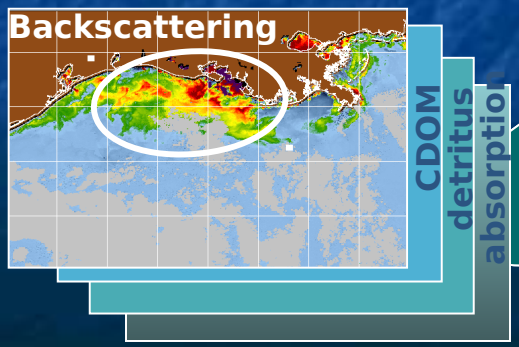


Improved
Decision Aide for
Ship Sampling
Sites

NO

YES

Advanced MODIS
Bio-Optical Anomaly Products



Under
Evaluation

Next Day
Forecast
(Future Capability)

MODIS Products used in Real-Time

Fusing of MODIS Products With:

Physical Models Ocean/ Atmospheric Parameters

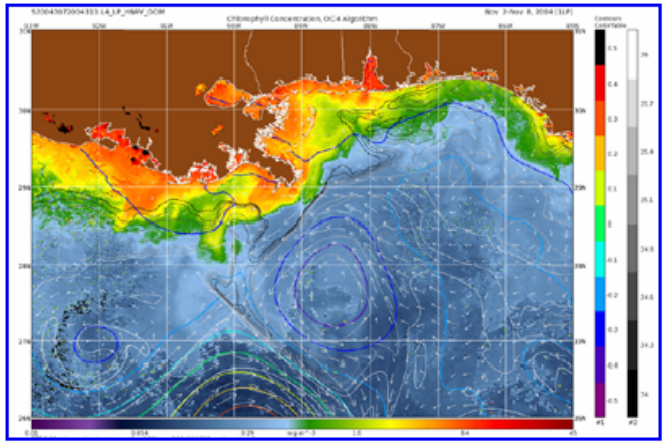
Providing

Initialization Validation

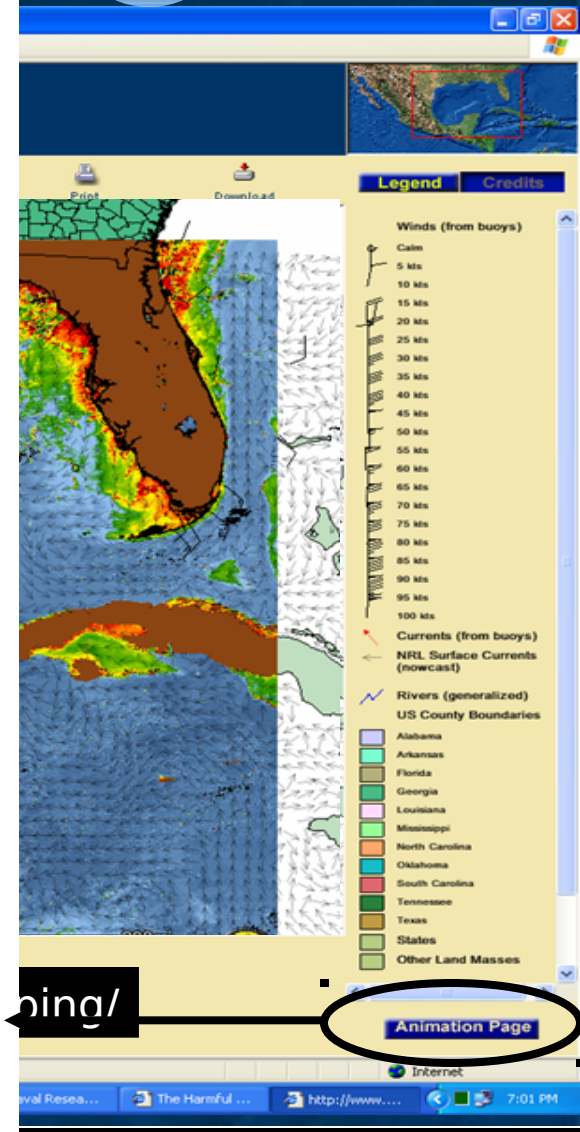
Defining Biological

Monitoring the Coastal Response Provid

These animations have been provided by the Naval Research Laboratory, Ocean Sciences Branch, Ocean Optics Section (http://www7333.nrlssc.navy.mil)



Description	File Size	Link
7 day animation of sea surface elevations, sea surface salinity, sea surface currents, and chlorophyll for the Gulf of Mexico - low resolution	~8MB	Gulf of Mexico Movie Loop
7 day animation of sea surface elevations, sea surface salinity, sea surface currents, and chlorophyll for Florida coast - high resolution	~6.5MB	Florida Coast Movie Loop
7 day animation of sea surface elevations, sea surface salinity, sea surface currents, and chlorophyll for Mississippi coast - high resolution	~6MB	Mississippi Coast Movie Loop
7 day animation of sea surface elevations, sea surface salinity, sea surface currents, and chlorophyll for Texas coast - high resolution	~6MB	Texas Coast Movie Loop
7 day animation of sea surface elevations, sea surface salinity, sea surface currents, and chlorophyll for Tampa area - high resolution	~7.5MB	Tampa Movie Loop
7 day animation of sea surface elevations, sea surface salinity, sea surface currents, and chlorophyll for Veracruz area - high resolution	~1.2MB	Veracruz Movie Loop



ping/

g, Ag, Ad, PIM, POM, FLUOR,
p, Salinity, PAR, Particle Size,
Blended, Latency & Anomaly)

NRL -> NCDDC -> DMR

2 Scenes / Day

Salinity

Turbidity/Gradient

TSS

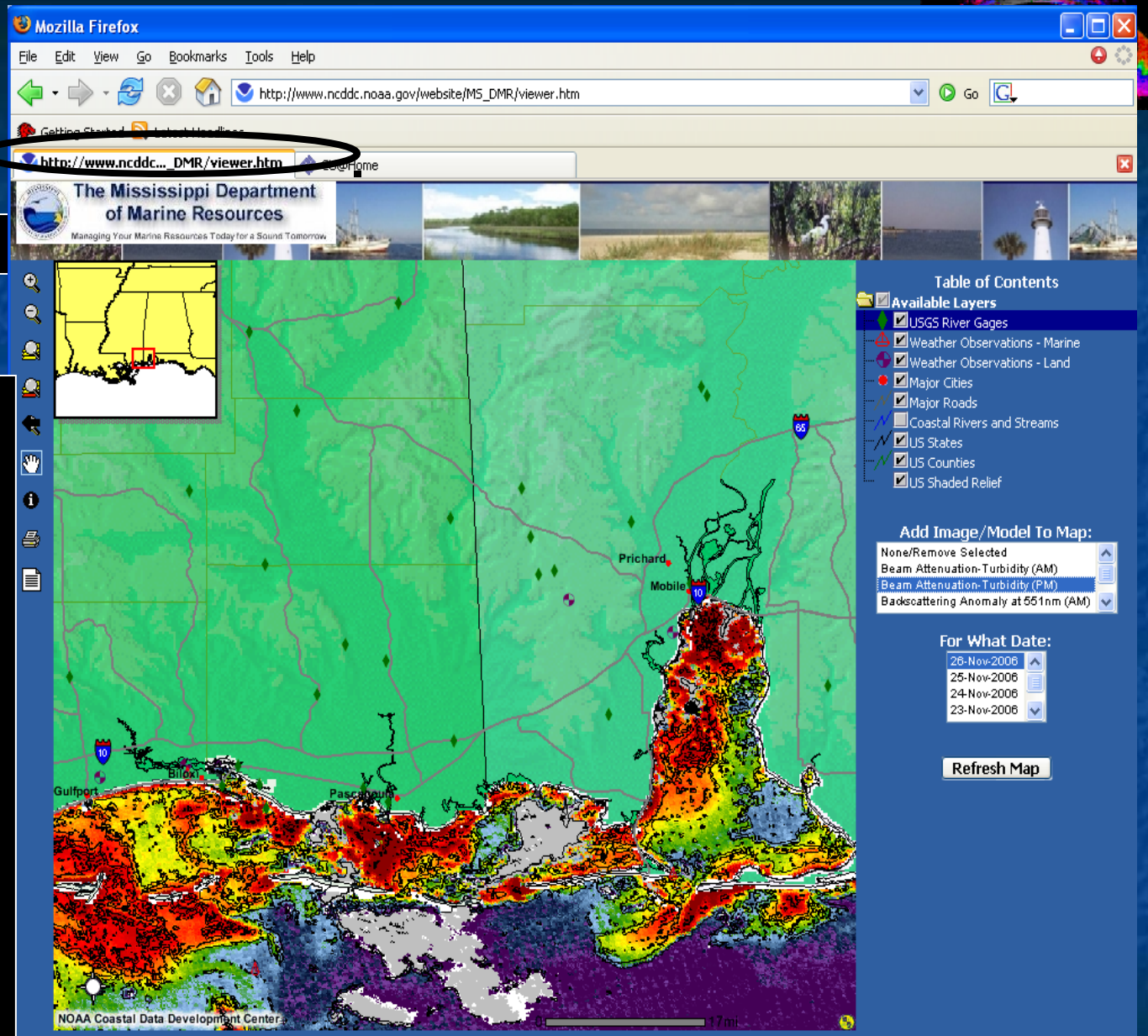
SST

Backscattering

Absoption (Phytoplankton, CDOM, Detrital)

Anomaly Fields

Modeled Currents, SSH, Salinity & Temperature



NEW

NRL
↓
NCDDC
↓
EPA

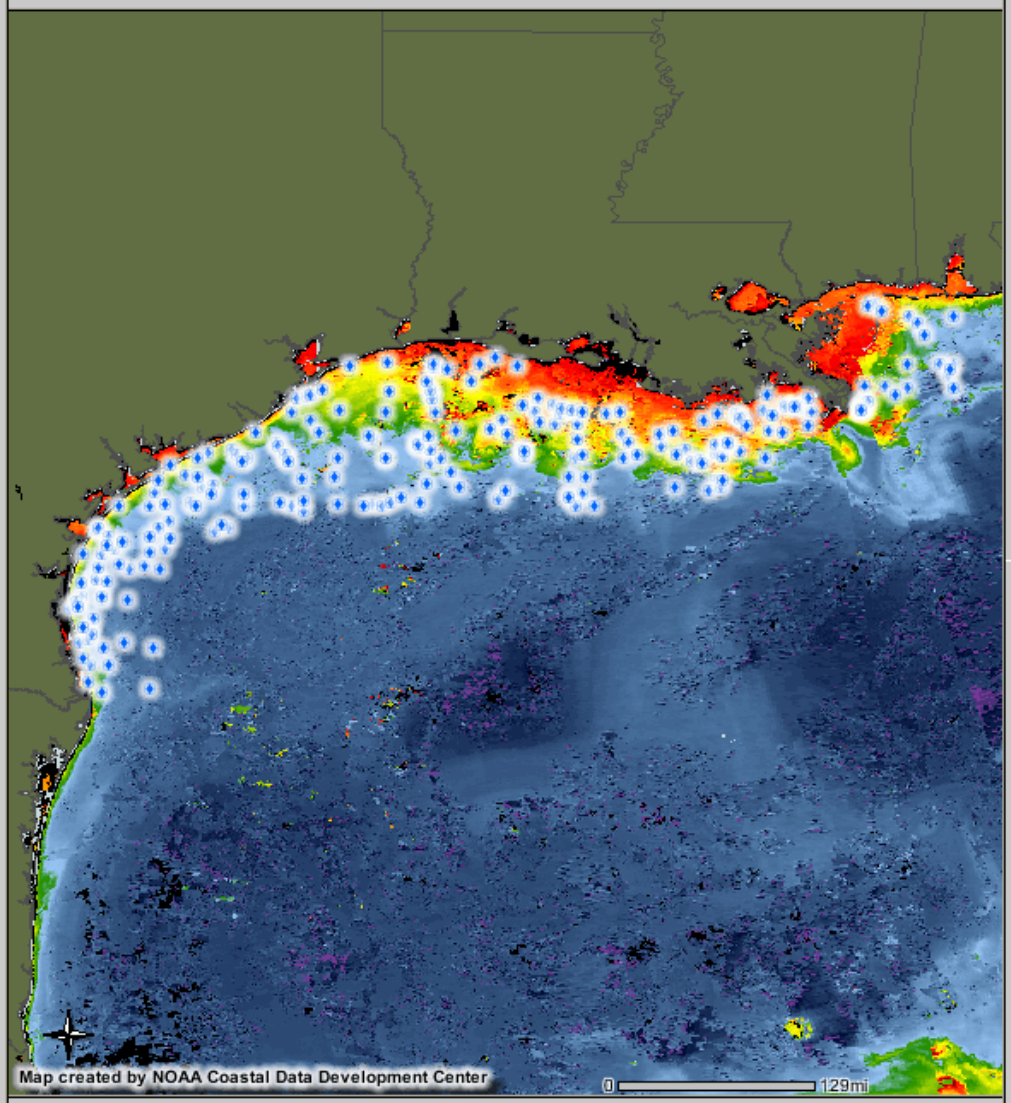
CHL

More Products Will Be Added In Near Future

Gulf of Mexico HYPOXIA Watch

Table of Contents

- 2006 Season
  - Station Locations
  - 2006 Ship Track
  - Dissolved Oxygen Contours
- NRL MODIS
- 2002-2005 Hypoxia Data
- Base Map Data



Help

Dissolved Oxygen Contours (mgl)

- 0-0.5
- 0.51-1.0
- 1.01-1.5
- 1.51-2.0
- 2.01-2.5
- 2.51-3.0
- 3.01-3.5
- 3.51-4.0
- 4.01-4.5
- 4.51-5.0
- 5.01-5.5
- 5.51-6.0
- 6.01-6.5
- 6.51-7.0
- 7.01-7.5

NRL MODIS

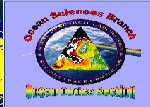
chl

45
8.4
1.6
(mg/m³)
.29
.054
.01

Refresh Map

--Click on a folder in the Table of Contents to view the layers inside.
--MODIS data layers can only be viewed one layer at a time. Imagery is unavailable for some dates.





Naval Research Laboratory Code 7333 - Ocean Optics - Bldg 1009 Room A107
Stennis Space Center, MS 39529

This is an Official U.S. Navy Web Site (Security and Privacy Notice)

Navy Links

NRL-DC	NRL-SSC	NRL-MRY
NAVO	ONR	U.S. Navy
Ocean Sciences Branch Home		
Oceanography Division Home		
Freedom of Information Act		

The REASoN Project
Gulf of Mexico Oceanography (Real Time - Ocean Weather)

The REASoN project provides a real-time view of the ocean environment derived from NASA and NOAA satellites . The satellite imagery when combined with available coastal observations and ocean models, provides methods for monitoring and detecting changes in the ocean environment on scales of hours, days, weeks and years. This research project is aimed at providing to marine managers the ability to make informed decisions based on the coastal environment. The real-time ocean products represent scientific algorithms tailored to a user's specific needs for coastal management. The overall goal is to maximize the value of NASA's Earth Observing Satellites to the coastal management decision makers, educators, students and interested residents of our Nation's coastal areas through collaboration with NOAA agencies. The REASoN Project is a cooperative effort of the Naval Research Laboratory, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, and ACT corporation. Funding for the REASoN Project has been provided by NASA, NOAA, and others.

Atmosphere NRL-Monterey | *NASA - Ocean Color* | *NOAA - NCDDC - HABSOS* | *NRL- SSC LAS Server* | *NRL- SSC WIPE Server*

Latest Imagery

Satellite Remote Sensing / Ocean Color Website

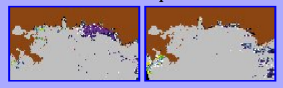
MODIS (DODS)

- Level-3 Mosaic:

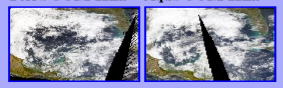
Terra MSB 250m | Aqua MSB 250m



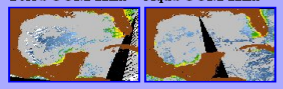
Terra MSB 250m | Aqua MSB 250m



Terra GOM 1Km | Aqua GOM 1Km

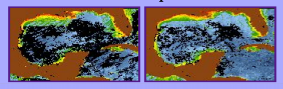


Terra GOM 1Km | Aqua GOM 1Km



- Level-4 Latest Pixel Composite:

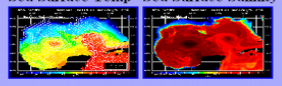
Terra GOM 1Km | Aqua GOM 1Km



Navy Coastal Ocean Model (NCOM) Website

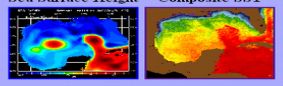
- Intra-America Seas (DODS)

Sea Suface Temp | Sea Suface Salinity



FLI Movie | *FLI Movie*

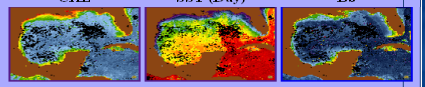
Sea Suface Height | Composite SST



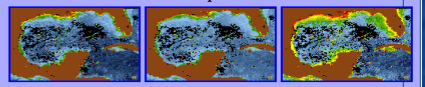
FLI Movie

- Blended Data Sets (DODS)

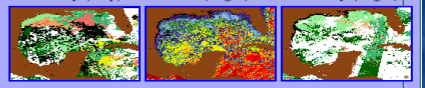
CHL | SST (Day) | Bb



Atotal | Aph | CDOM



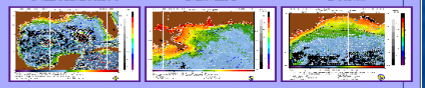
Latency (Day) | SST (Night) | Latency (Night)



Blended Browse Directory Listing

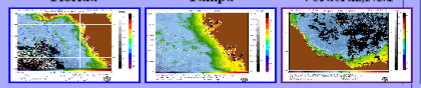
- Merged MODIS Aqua Chlorophyll w/ NCOM

GulfofMexico | MS/LA | Texas



AnimGIF (Latest) | *AnimGIF (Latest)* | *AnimGIF (Latest)*

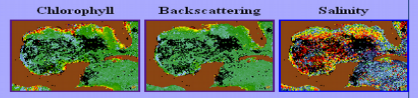
Florida | Tampa | Veracruz,NM



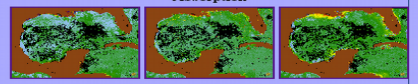
AnimGIF (Latest) | *AnimGIF (Latest)* | *AnimGIF (Latest)*

- Anomaly Data Sets (DODS)

Chlorophyll | Backscattering | Salinity

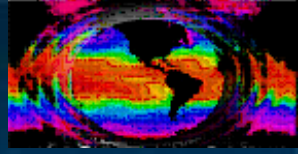


CDOM Absorption | Phytoplankton Absorption | TSS



Anomaly Browse Directory Listing

Data Availability



Models and Remote Sensing
"Internal Browse"
Of ongoing + new Products

Outside
Data available

ftp→ Blended Products → NCDDC

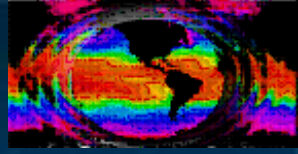
DODS interface .

Data Fusion provides
New capability

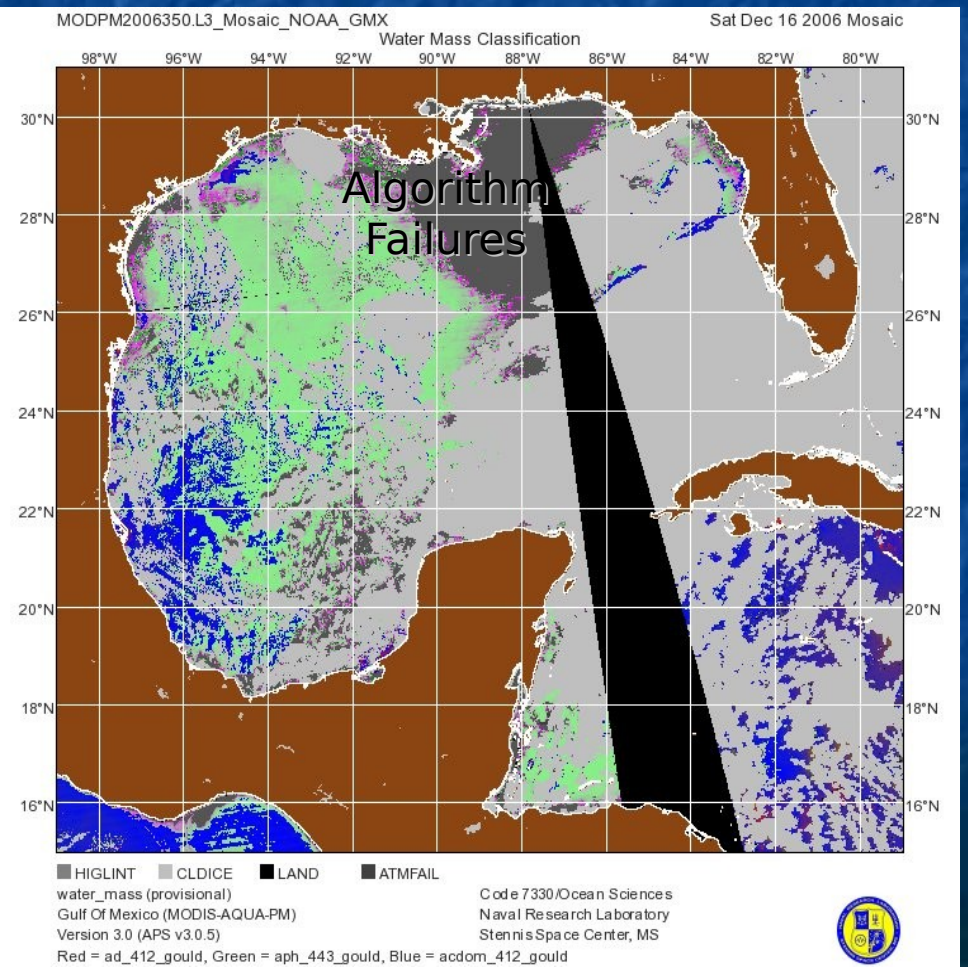
http://colbalt.nrlssc.navy.mil:8000

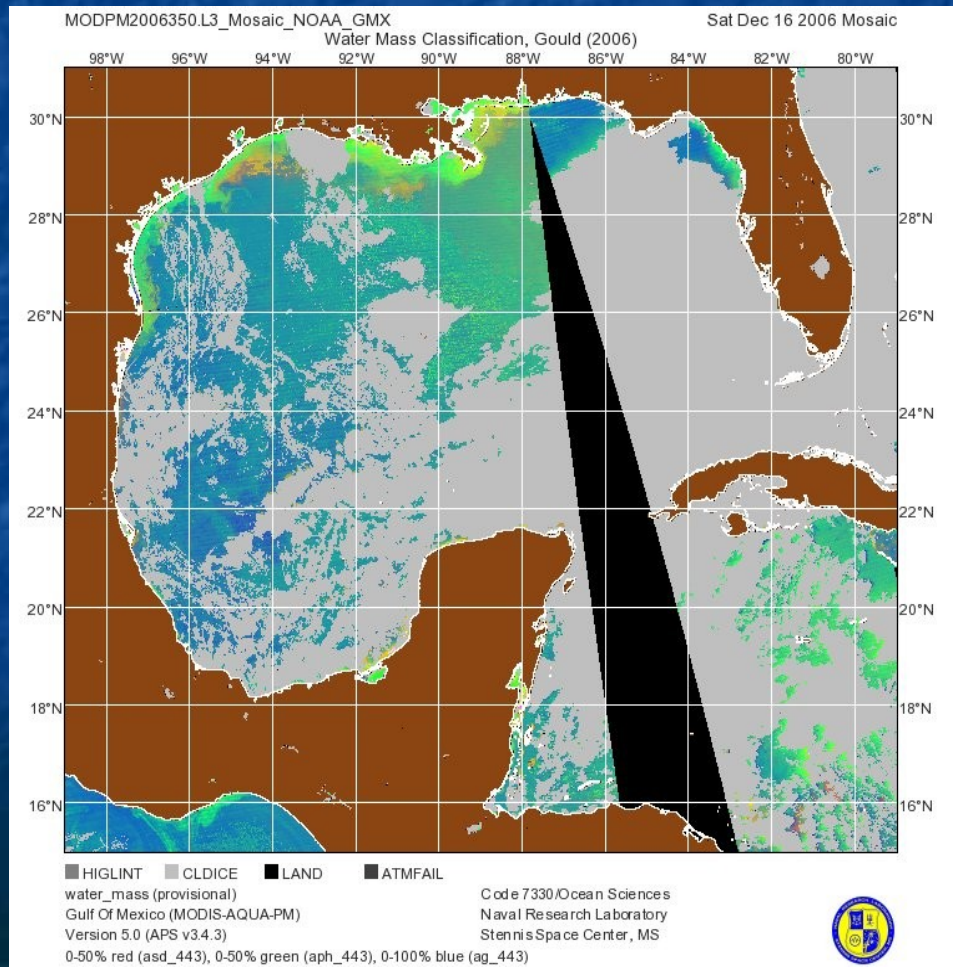
APS RECENTLY UPGRADED :

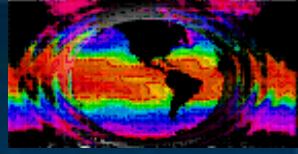
New Products, Enhanced Algorithms, etc.



OLD Wmass(Gould) NEW







Possibilities for NRL support to DMR?

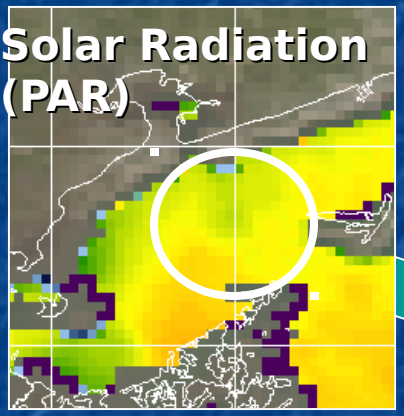
mplementation of Decision Aids using Satellite
nd Model Products

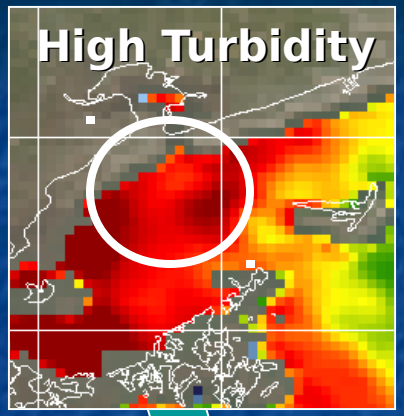
- Automated product generation
- Daily product delivery
- Examples of Fecal Coliform algorithms from Chigbu, et al., 2005
- Time Series Data over Oyster Beds
- Tracking dispersion of particles (or water masses) ????

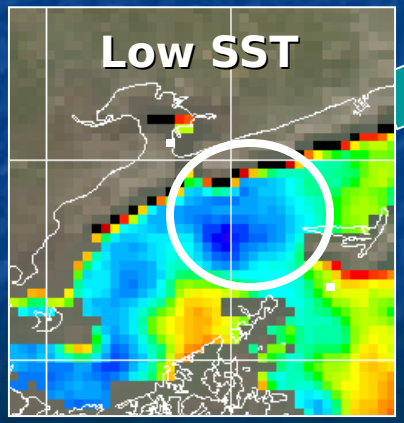
Potential Applications of Oyster Reef Management in the Mississippi Sound

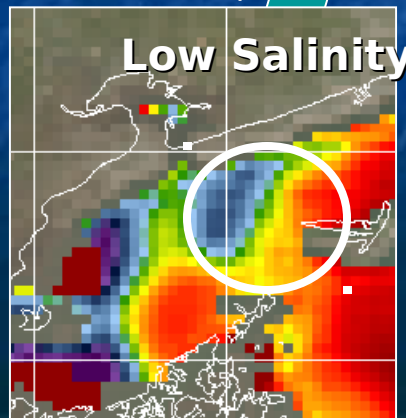
Mississippi
Department of Marine Resource
NOAA/Naval Research Laborato

MODIS Products
Used for Managing
Coastal Resources









Decision Support
MODEL
Oyster Reef
Closure

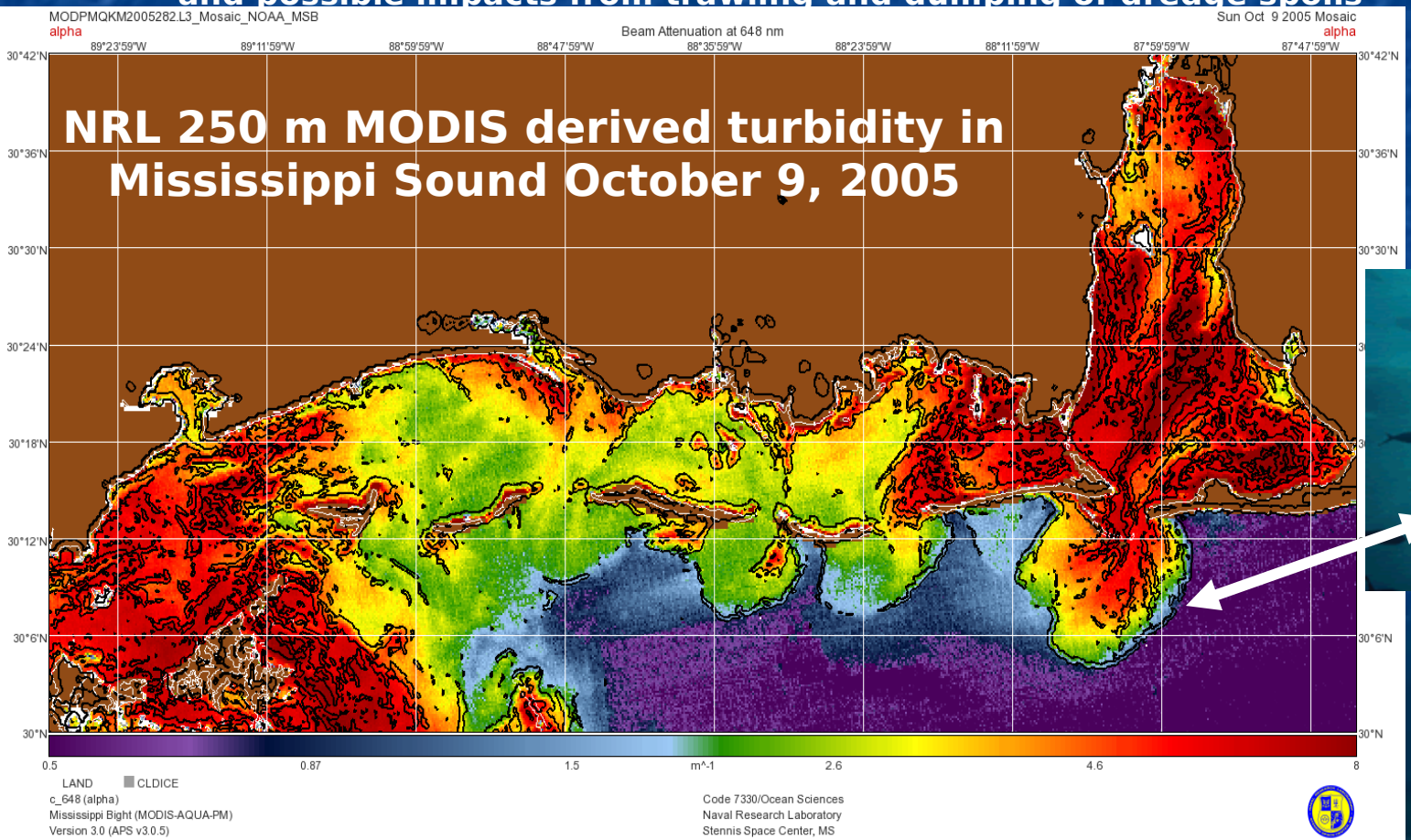




- High levels of fecal coliform can contaminate or indicate contaminated oysters requiring DMR officials to close the oyster reefs
- Fecal coliform die-off rates and predictions of concentration can be correlated to relative solar radiation, cloud cover, SST, river runoff (turbidity) and salinity.
- NRL Stennis is providing MODIS derived estimates of solar radiation, SST, and turbidity as well as salinity estimates
- NOAA NCDDC provides these data to Mississippi DMR for use in their fecal coliform decision tools.

Locating Turbidity fronts in the Mississippi Sound

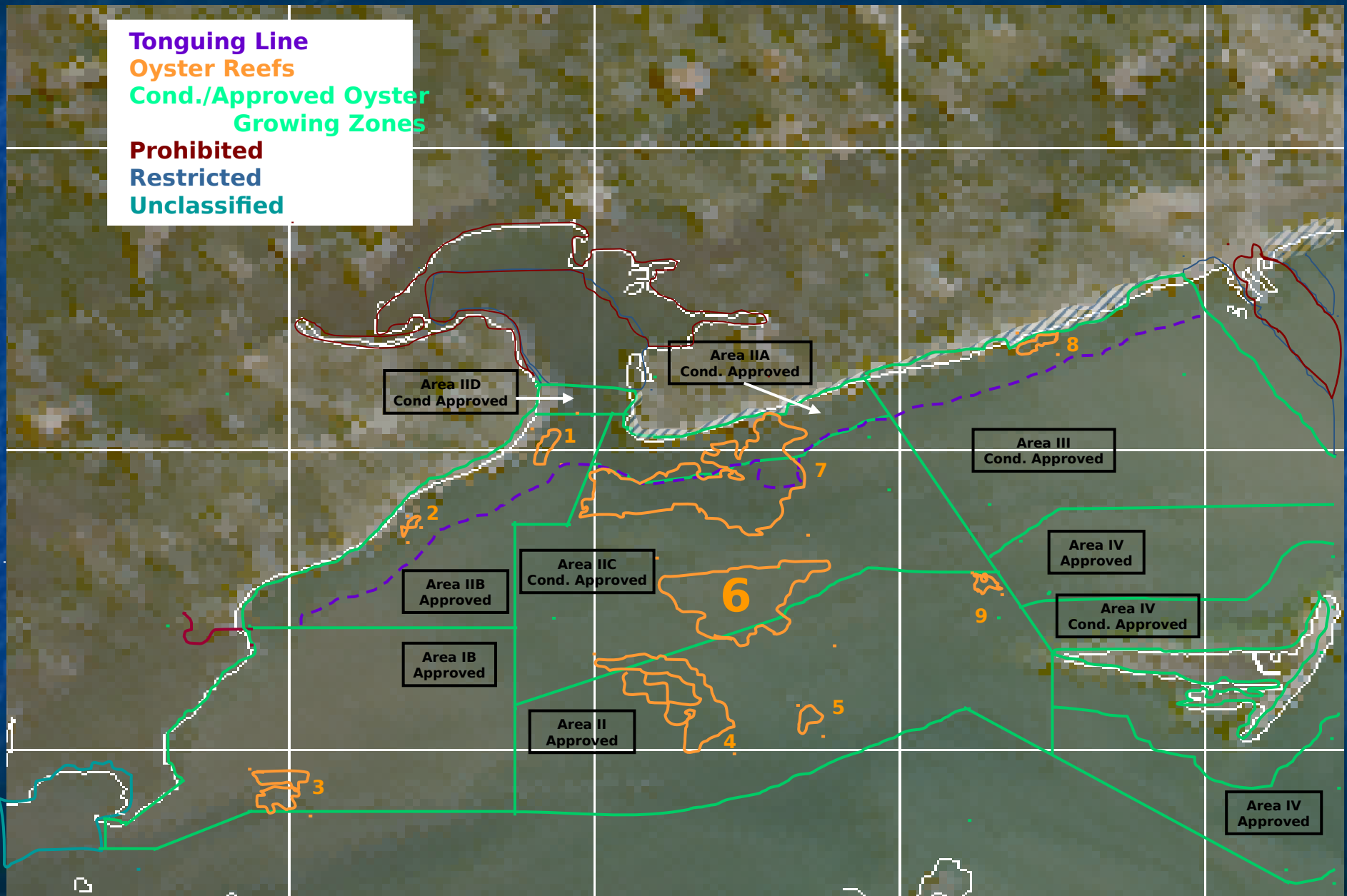
- **Estuarine-dependent and coastal fish species production is enhanced in the vicinity of riverine discharges**
  - **Larval fish densities are highest at the associated turbidity fronts**
  - **Tracking overall turbidity in Mississippi Sound is important for monitoring the health of submerged aquatic vegetation (SAV) such as sea grasses**
  - **Large areas (some estimates as much as 60% of the total area) of SAV have been lost in Mississippi Sound in the past 30 years**
  - **SAV provides critical habitat for many recreational and commercial fish species**
  - **Sediment fall-out areas can be monitored for changing patterns of deposition and possible impacts from trawling and dumping of dredge spoils**





School of fish on clear side of turbidity front in Mississippi Sound

Oyster Growing Areas in Mississippi Sound

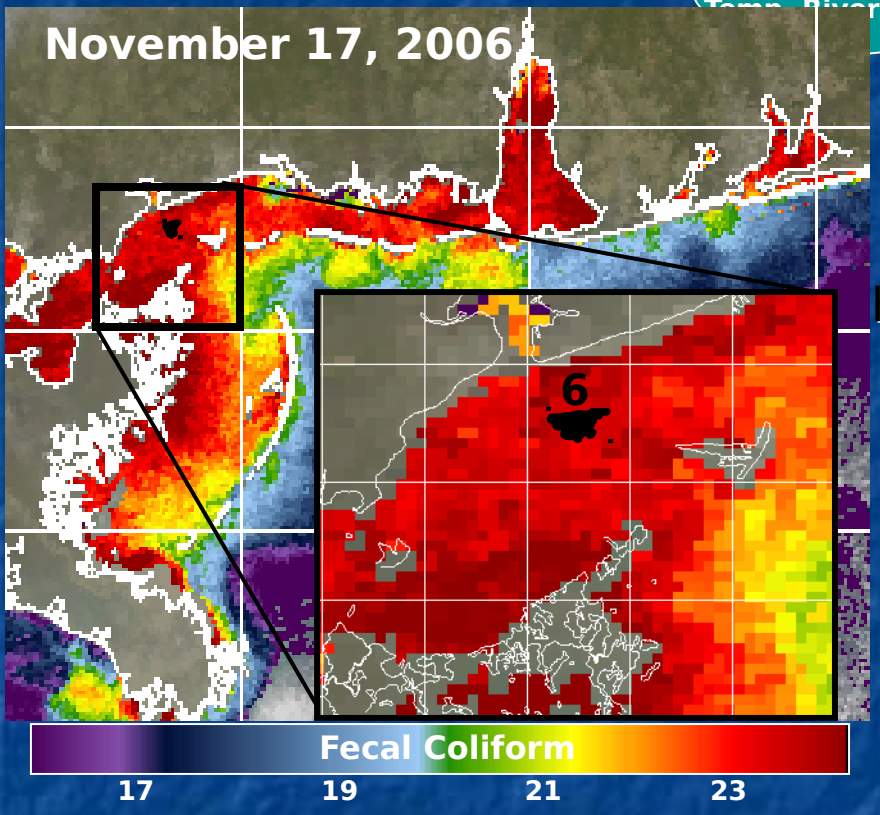


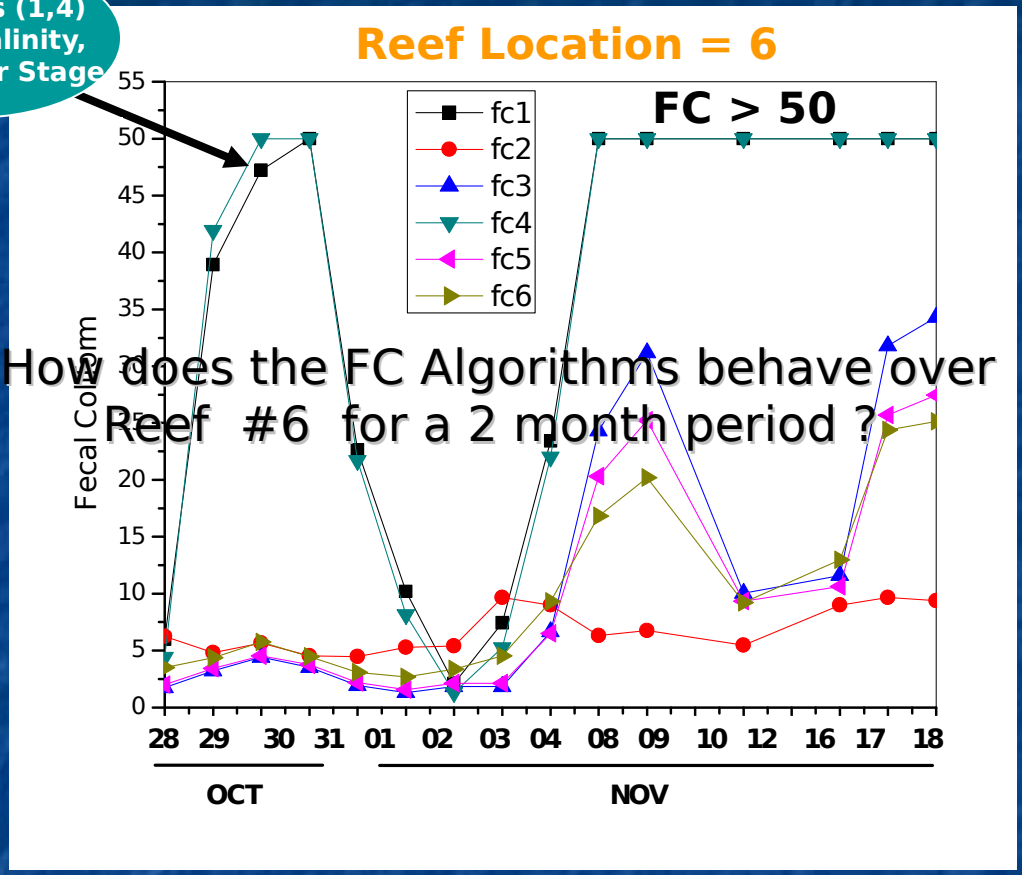
Fecal Coliform Estimates From Remote Sensing

(Time Series Oct.28-Nov.18, 2006)

Real-Time Implementation of Algorithms

Algorithms (1,4) Contain Salinity, Temp, River Stage





How does the FC Algorithms behave over Reef #6 for a 2 month period ?

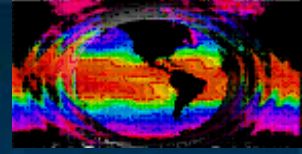
tionships:

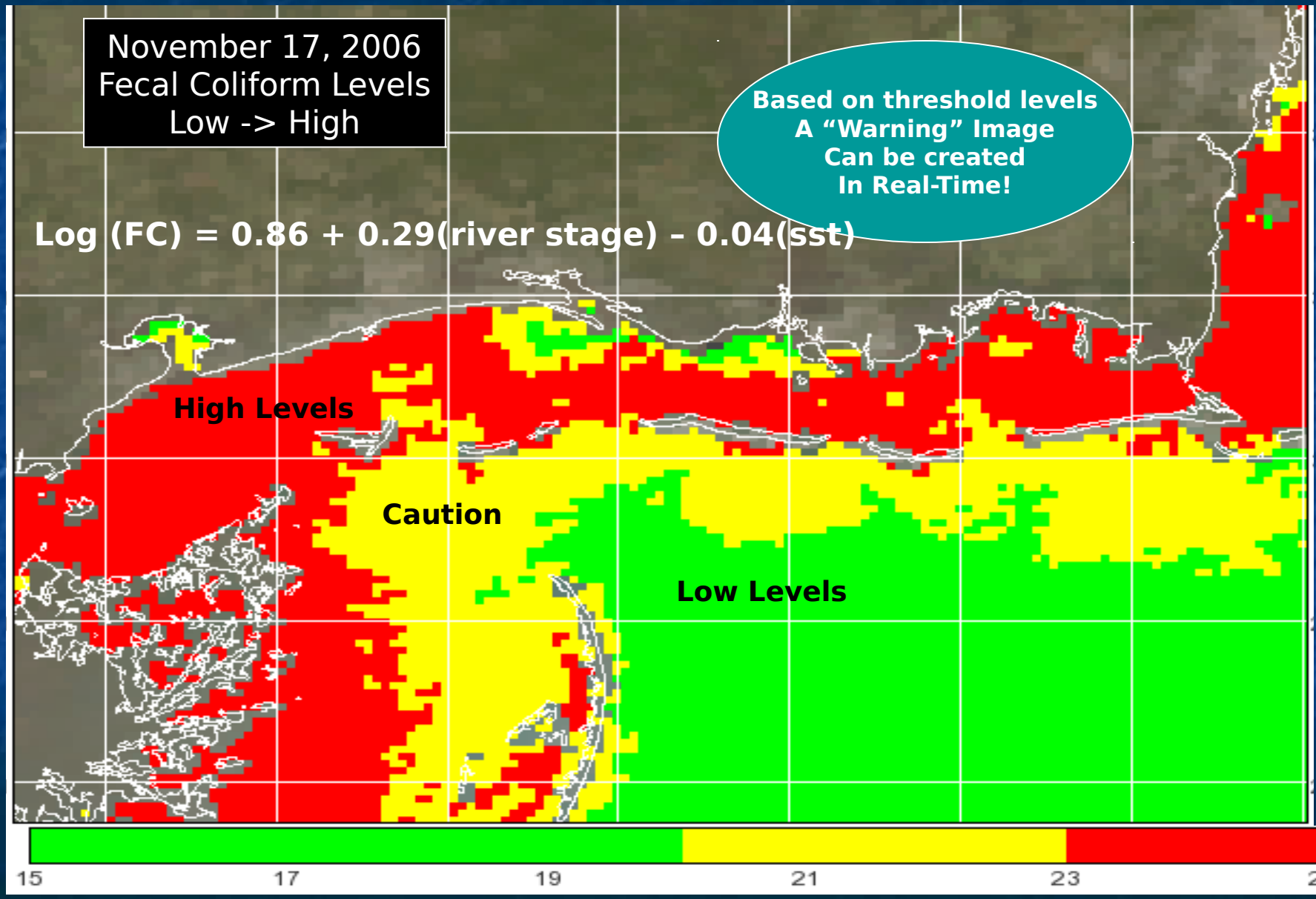
Log (FC) = 1.39 + 0.59(river stage) + 0.06(salinity) – 2.04
Log (FC) = 5.21 – 3.41Log(sst)
Log (FC) = -0.56 + 0.49(river stage)
Log (FC) = -0.99 + 0.72(river stage) – 0.04(sst) + 0.07(sali
Log (FC) = -0.40 + 0.43(river stage)
Log (FC) = 0.86 + 0.29(river stage) – 0.04(sst)

Reference:

Paulinus Chigbu, Scott Gordon and Paul B. Tchounwou. The Seasonality of Fecal Coliform Bacteria Pollution and its Influence on Closures of Shellfish Harvesting Areas in Mississippi Sound. International Journal of Environmental Research and Public Health. 2005. pp.362-373.

Fecal Coliform Levels Derived From Remote Sensing Products





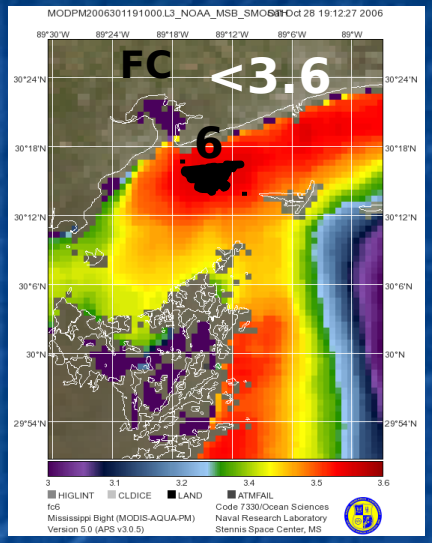
Fecal Coliform From Remote Sensing

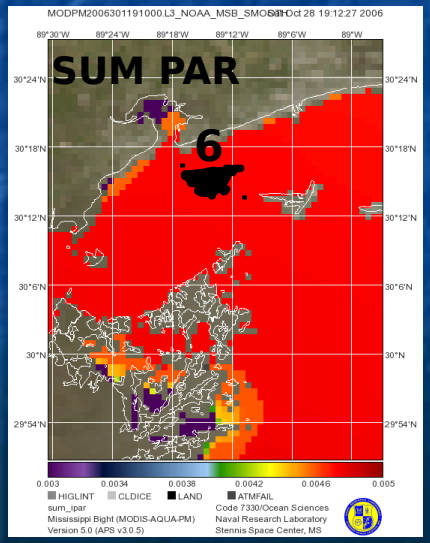
Time Series Reef #6 Product Comparisons

Fecal Coliform vs. PAR

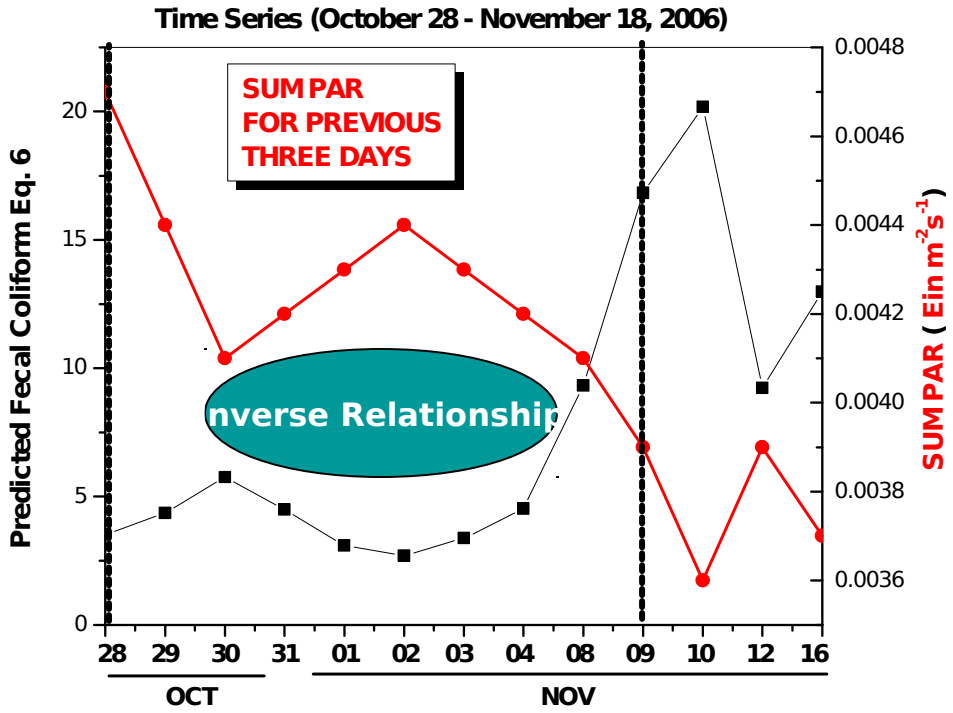
OCT. 28

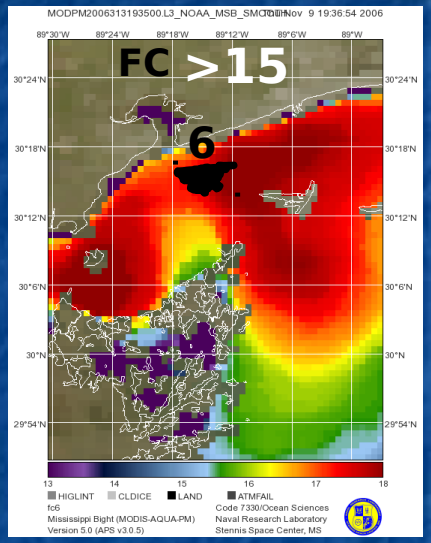
NOV. 09

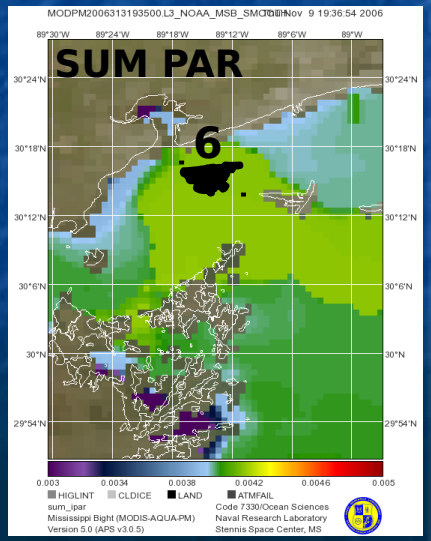




Real-Time display of Remote sensing products At desired locations







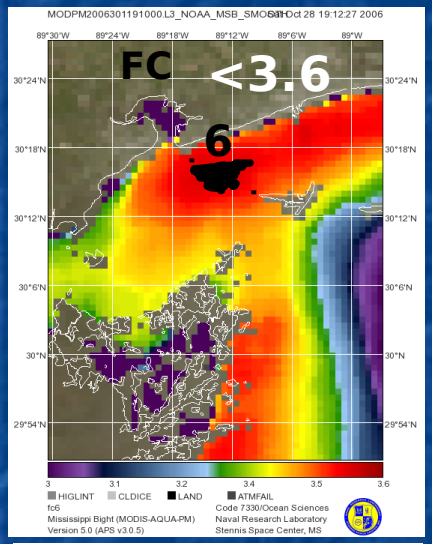
Log (FC) = 0.86 + 0.29(river stage) – 0.04(sst)

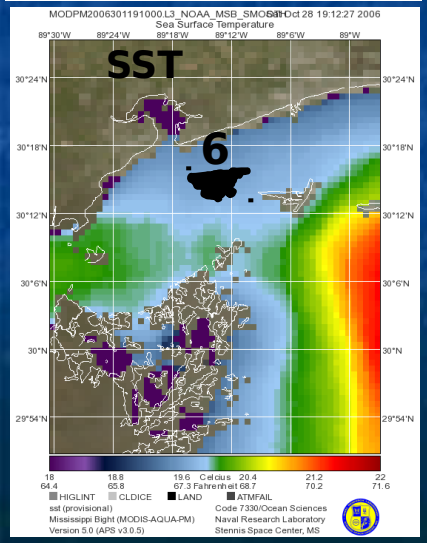
Fecal Coliform From Remote Sensing (Eq.6)

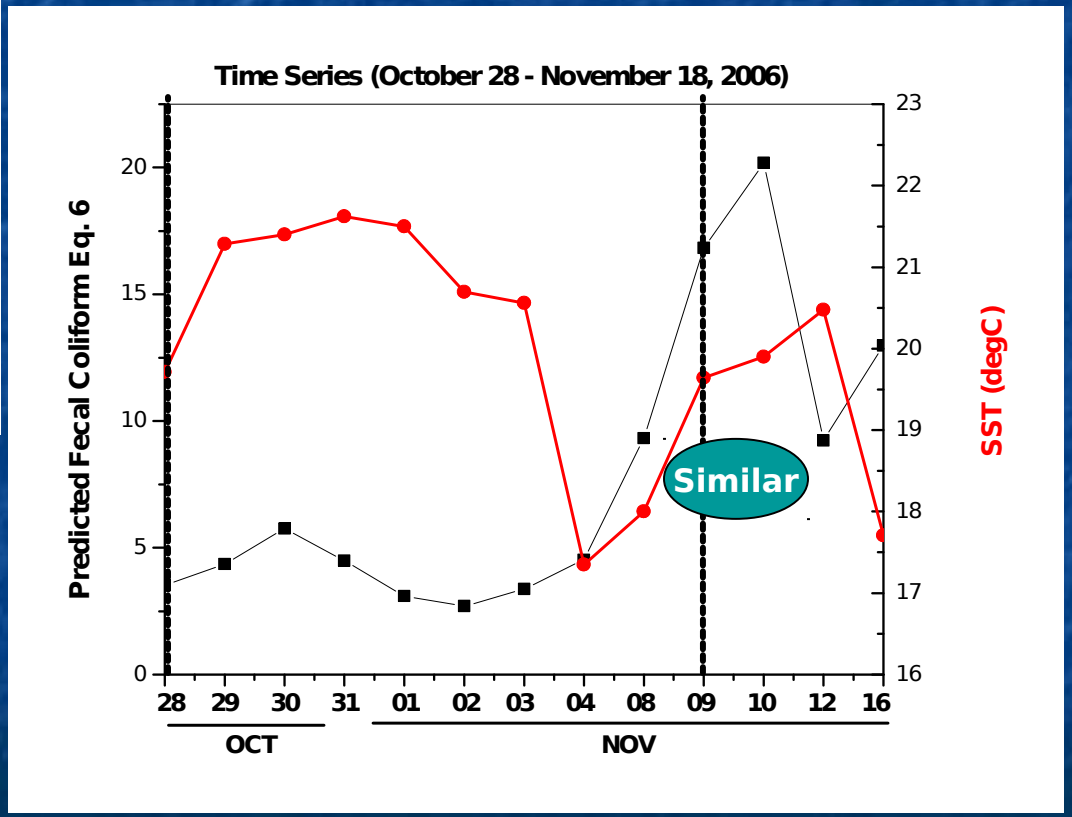
Time Series Product Comparisons

Fecal Coliform vs. SST

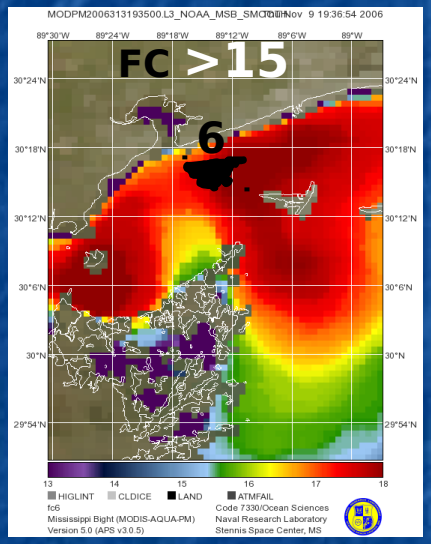
OCT. 28

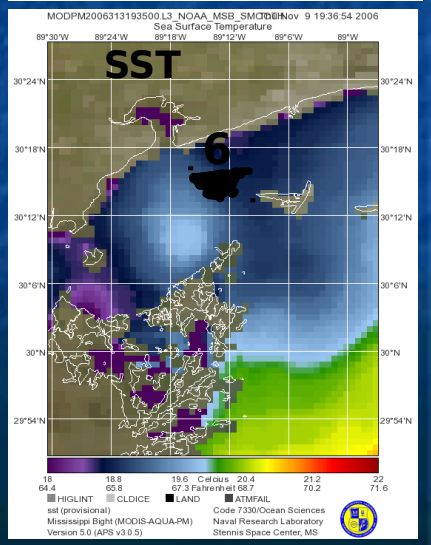






NOV. 09



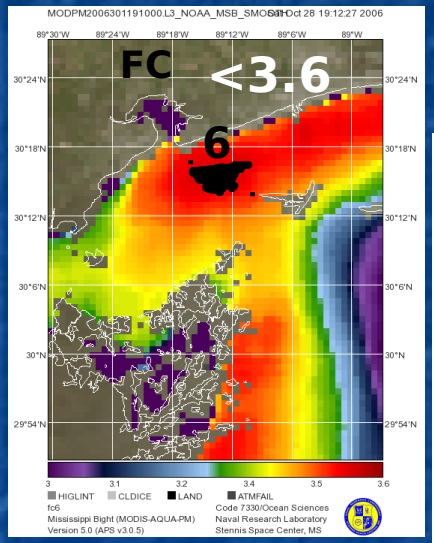


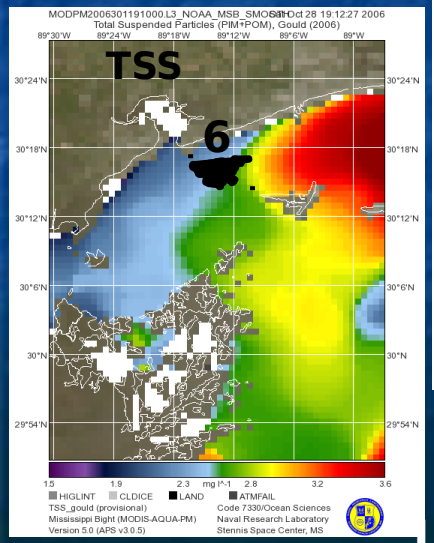
Fecal Coliform From Remote Sensing (Eq.6)

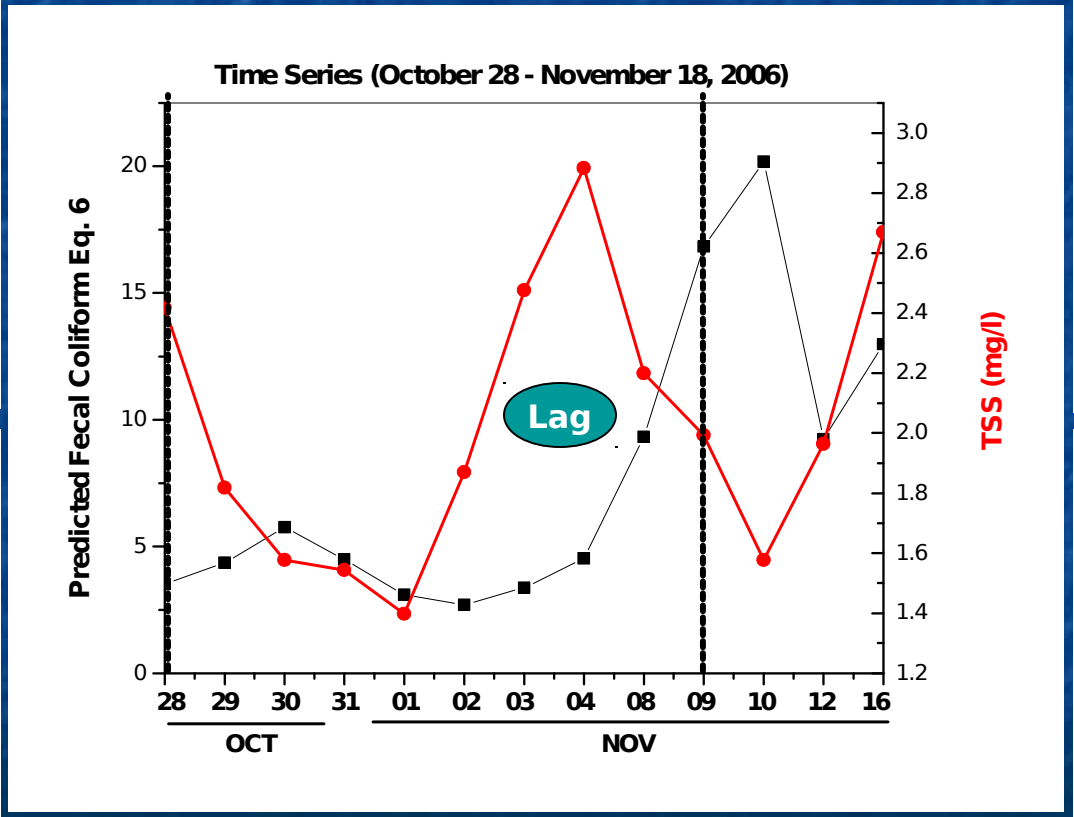
Time Series Product Comparisons

Fecal Coliform vs. TSS

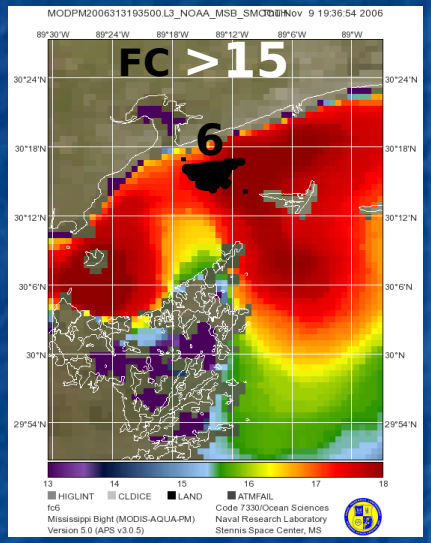
OCT. 28

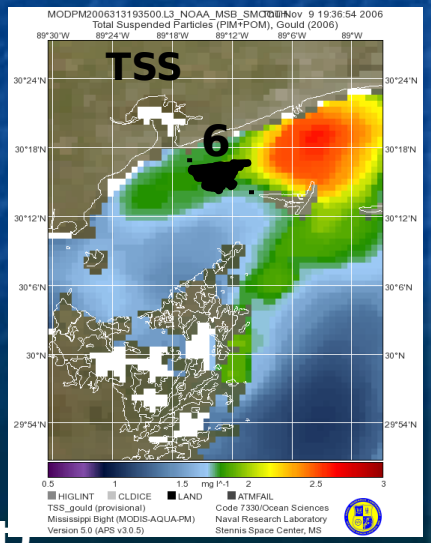






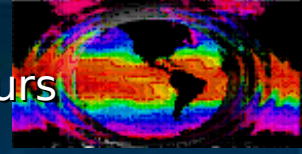
NOV. 09

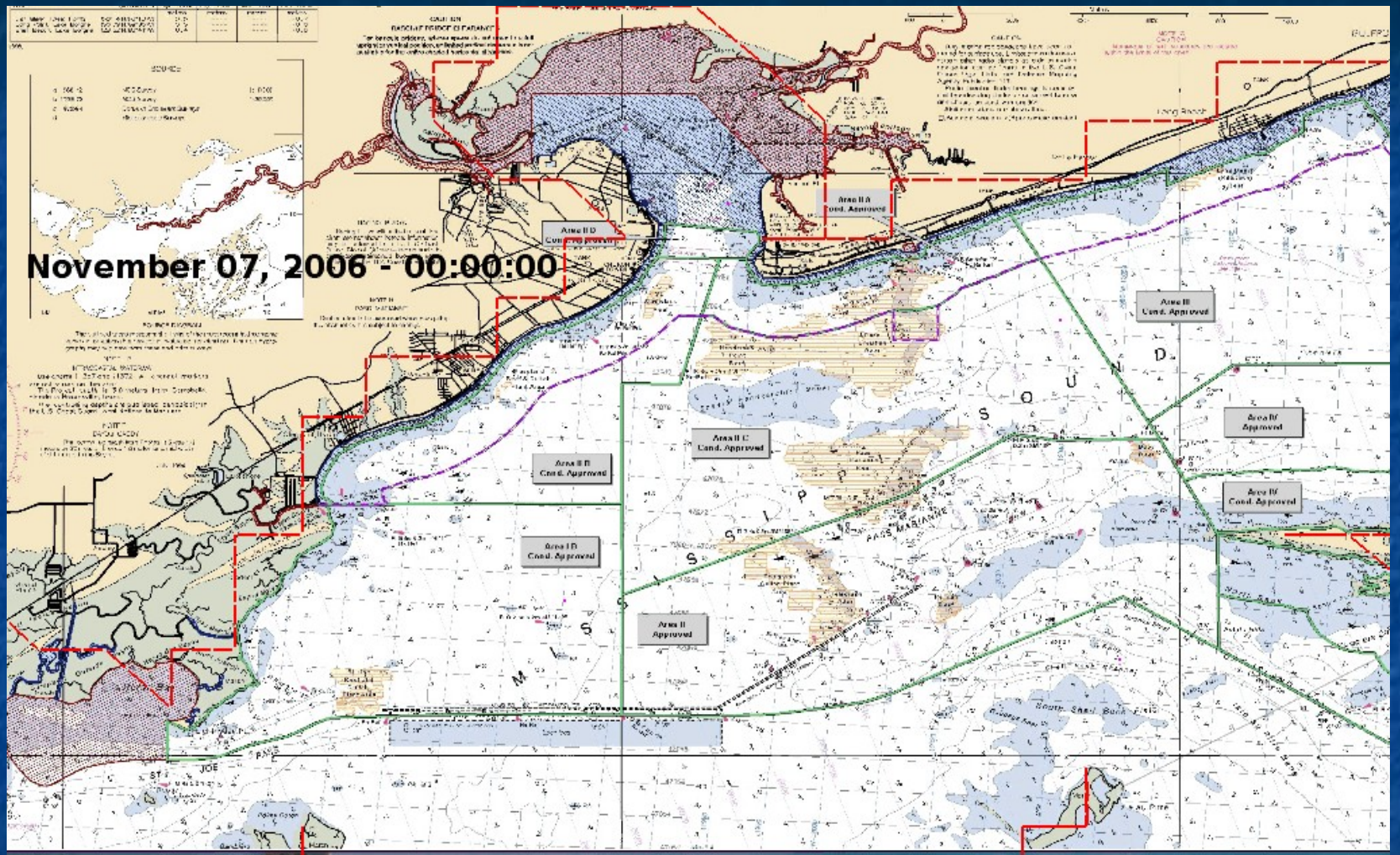




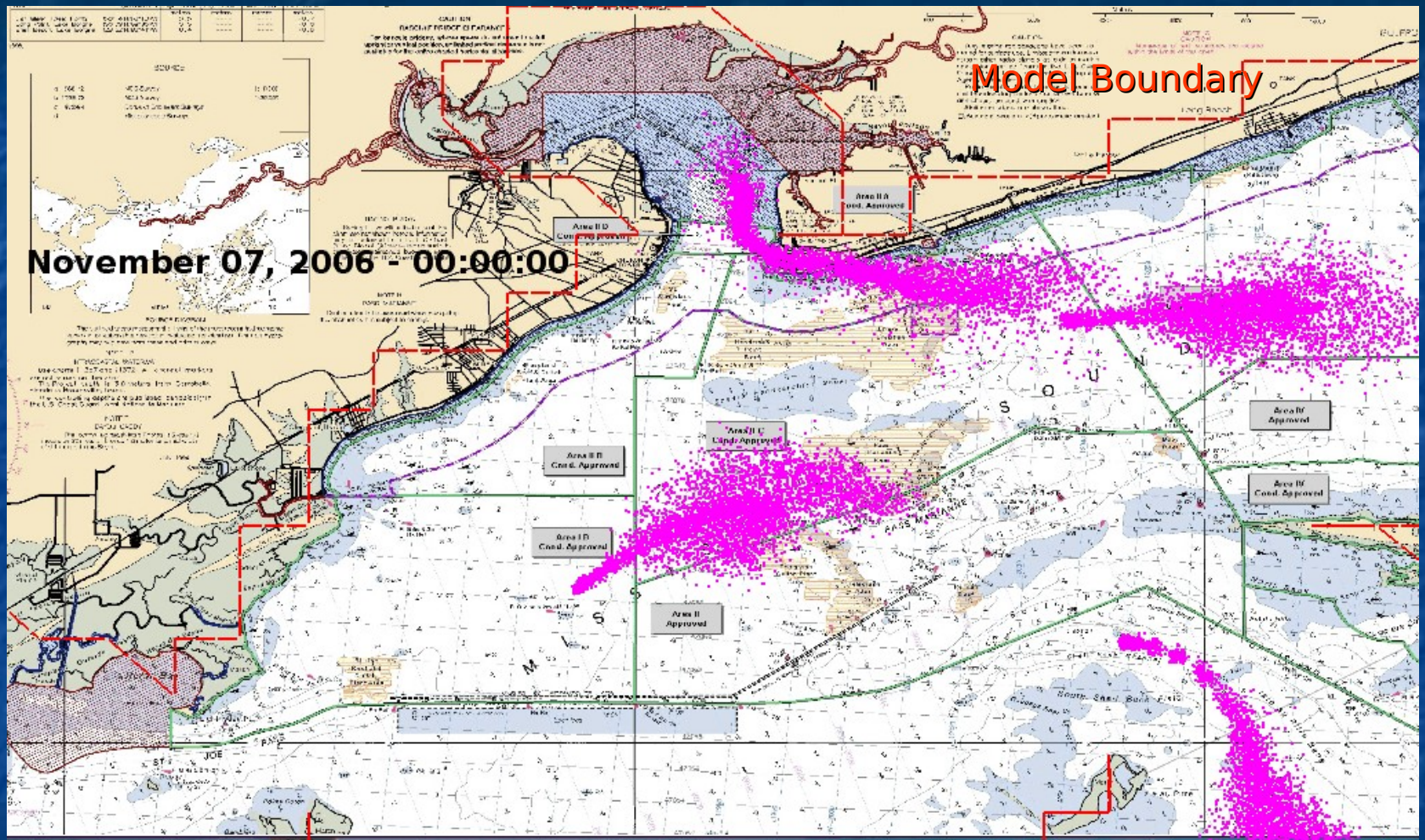
Log (FC) = 0.86 + 0.29(river stage) – 0.04(sst)

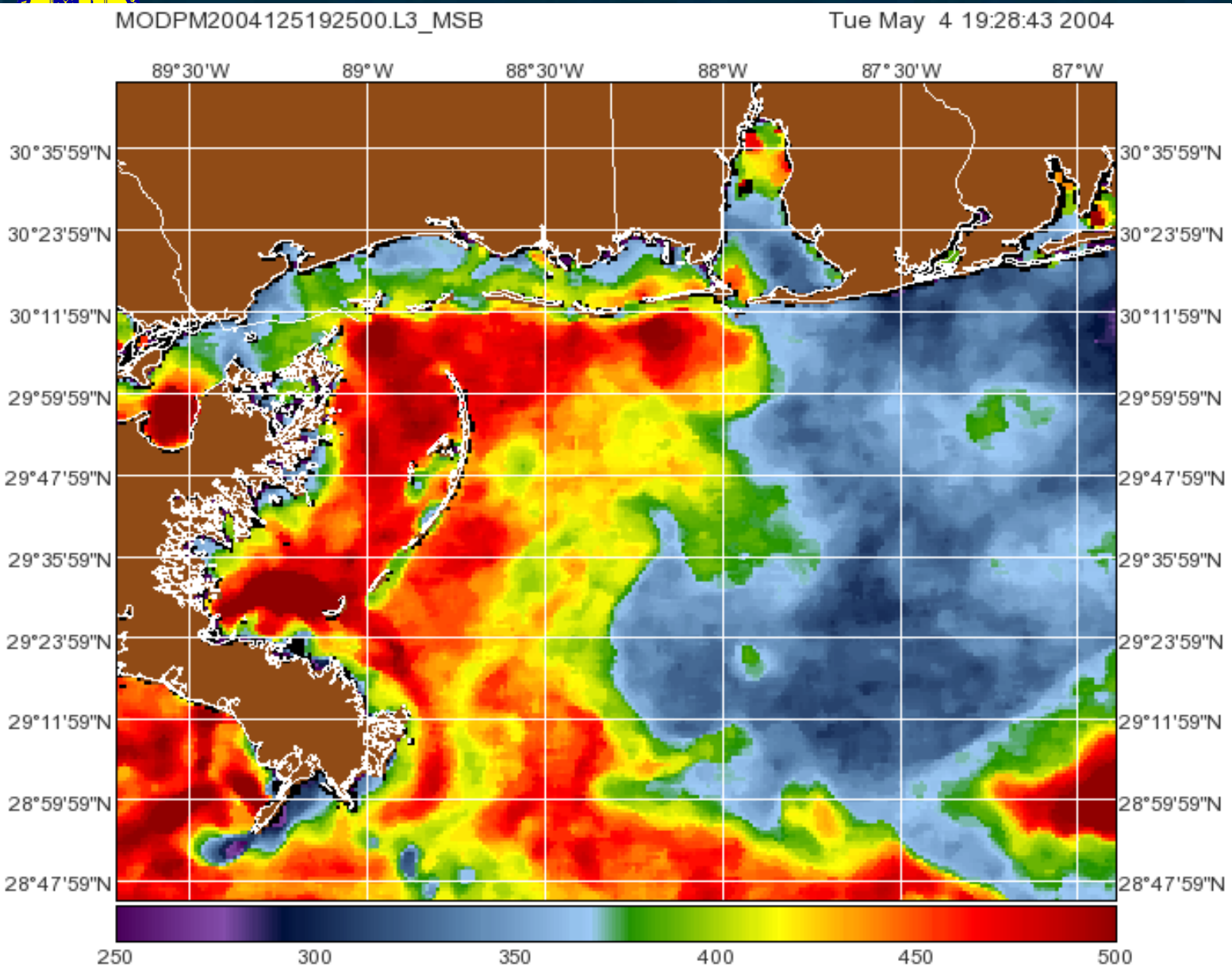
Contamination Source Points (Continuous Seed) dispersed over 48 hours





Using a Dispersion Model, how does water disperse over the Oyster Reefs. (48 hours)



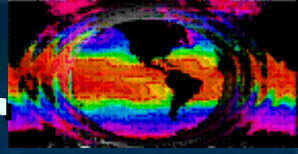


Mean Vp Predicted in Oysters using SST Model.

Model Applied here At NRL.

Future Investigations Will look at Vp, Salinity and Turbidity Relationships.

Summary – Ocean Weather



- Real time ocean products are available through NRL – NCDDC (Unique capability to Mississippi and Gulf of Mexico)
  - Presently we are establishing a model for U.S. Ocean Observing Systems
  - Establishing a “Ocean Weather” capability
- NASA/NOAA/NRL working to provide a link of research to operations
- Customized products are “easy” to develop from present architecture (See us)
- Potential products are available to support “decision making process”
  - Ship sampling programs
  - Potential “threat” areas
  - Historical studies /

  * Algorithm Implimentation
- Website / real time monitoring network exist at Stennis
  - Invitation to Visit real time room.
- New Products are being generated monthly → GOOGLE EARTH
- Request feedback on products and how products are used.